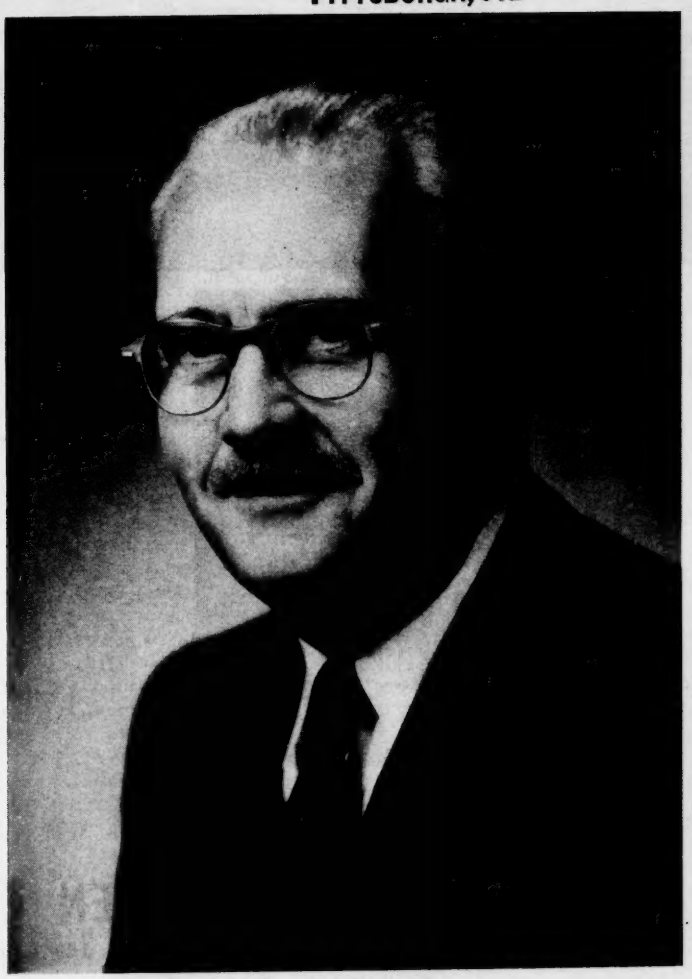
Metals Review

PITTSBURGH, PA.



April 1957

Walter H. Holcroft
Holcroft & Co.
(See Article, Page 4)

HOLDEN
METALLURGICAL PRODUCTS
TRADE MARK REGISTERED

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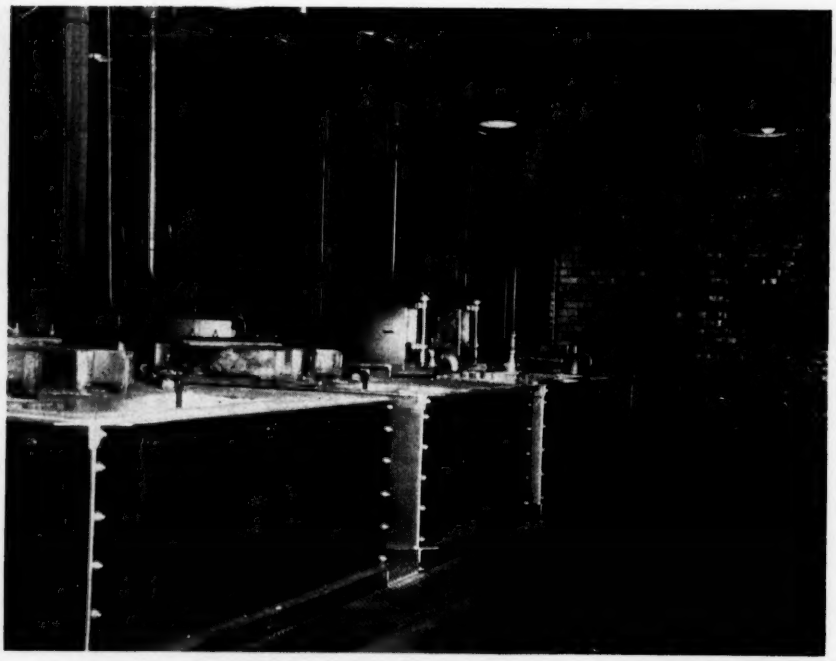


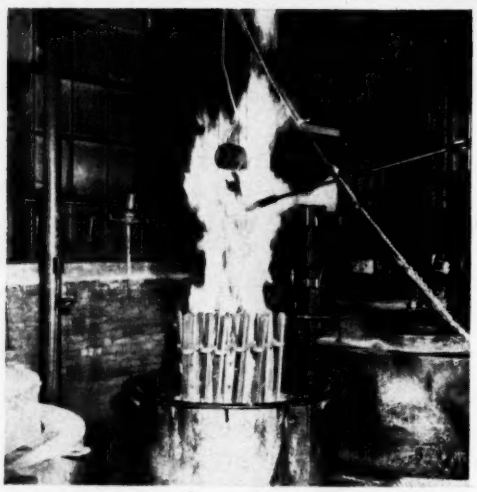
EQUIPMENT:

1—HOLDEN TYPE 701-4
1300° to 1550° F.
Working Dimensions—
48″ x 24″ x 72″.

1—HOLDEN TYPE 701-4
1550° to 1850° F.
Working Dimensions—
36″ x 24″ x 72″.

1—HOLDEN TYPE 401
350° to 700° F.
Working Dimensions—
48″ x 24″ x 72″.

1—HOLDEN TYPE 202-4
350° to 1100° F.
Working Dimensions—
48″ x 24″ x 72″.



Holden Type 401 furnace covered by U. S. Patent 2.516.516

PRODUCTION CAPACITY—1000 lbs. per hour

FIRE HAZARD . . .

Salt Bath Quenching — eliminates this basic problem.

PLUS VALUES . . .

Any SAE Steel now quenched in oil can be quenched in a HOLDEN Salt Bath . . . with many manufacturing savings.

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LOS ANGELES 58, CALIF. • 4700 East 48th Street
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Metals Review

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Holcroft Heads IHEA for '57

Walter H. Holcroft, executive vice-president and technical director of Holcroft & Co., Detroit, was elected president of the Industrial Heating Equipment Association at the recent annual meeting in Washington.

An active and long-time member of the American Society for Metals, Walter Holcroft keeps his hand in countless activities. With a 356-acre dairy farm in Byron, Mich., to keep him busy, his activities range beyond this to work with the Boy Scouts and his continuing interest in handball tournaments, mostly as a spectator at present, although he still enjoys playing the game.

Mr. Holcroft, a native of Chester, Pa., attended high school in Detroit and went on to the University of Michigan, where he graduated in 1926 with a bachelor's degree in chemical engineering. He has been associated with Holcroft & Co. since his graduation and as executive vice-president and technical director since 1948.

In 1955 Mr. Holcroft was selected as one of the recipients of the Trink's Industrial Heating Awards for his "outstanding contributions to this nation's economic and scientific progress in industrial heating". The award recognized his important contributions toward the development and improvement of gas carburizing furnaces and the development of carbonitriding and furnaces for that process. In addition, he was responsible for furthering the short-cycle malleable annealing process, which was developed by his uncle around 1922, and the development of furnaces for that process. He has also designed special furnaces for effective deep case carburizing and for hardening war material and holds several patents on a variety of processes.

His ingenuity and development work during World War II enabled companies holding war contracts to produce gears, pinions, etc., that were harder and tougher, with more uniform gradation in carbon and control of case depth.

Long active in A.S.M. and I.H.E.A., he also holds memberships in Kiwanis Club #1, Engineering Society of Detroit, and last year was elected a Detroit district councilor of A.S.T.M. He is the author of many technical papers. He is a frequent guest speaker before the local chapters of many of the technical societies.

A member of the Y.M.C.A. and the Detroit Athletic Club, Mr. Holcroft manages to find time to swim and play golf, thus helping him to keep in the trim so necessary for such an active man.

Talks on Close Tolerance Casting

Shown at a Meeting Held by the Rhode Island Chapter Are, From Left: Sidney Siegel, Chairman; Julius Ferrari, Vice-President, Victors Foundry, Inc., Guest Speaker; and William P. Matthew, Vice-Chairman. Mr. Ferrari presented a talk entitled "Recent Developments in Close Tolerance Casting, Featuring the New Carbon Dioxide Sand Curing Process"

Gives Talk at Penn State On the Gray Iron Foundry

Speaker: D. E. Krause

Gray Iron Research Institute, Inc.

The "Gray Iron Foundry" was the subject of a talk given by D. E. Krause of Gray Iron Research Institute, Inc., at **Penn State.**

Gray irons are almost exclusively foundry alloys and possess many properties which make them ideal for casting processes. Mechanical properties of this family of alloys are modified by the cooling rate of a casting.

A knowledge of microstructure, composition and metallurgy of gray iron will help one to understand variations in mechanical properties. Although carbon and silicon content have a predominant effect on these properties, other factors, such as melting practice, alloying and inoculation, also will cause modifications. A recent development is the conversion of graphite from flake form to nodular form by late treatment of the molten alloy with elements such as magnesium and/or cerium. Conversion to nodular graphite greatly increases the strength of graphite-containing cast iron.

Casting practice is one of the important variables in foundry work and within the past decade considerable progress has been made in this direction. In most cases the objective has been to cast to closer tolerances, thus reducing machining costs. In some cases it is now possible to cast to final form and completely avoid machining.

The fear that gray-iron castings would be replaced by plastics, die castings, stampings, etc., has not materialized, in fact gray iron consumption has been steadily increasing. Mr. Krause believes this growth was caused by application of engineering principles in conjunction with skills and manual arts developed over many years. He stressed the need for continued applications of scientific methods and the improvement of quality by automatic control equipment.

By very close control, castings, whose properties closely approach those of forgings of similar composition, can be made. This is particularly true in aircraft parts where expensive machining can be greatly reduced by castings coupled with close quality control.

Mr. Krause concluded his talk by stating the need for engineers in the management division of foundries. Persons are needed in this branch of the industry who have the background and ability to keep up with technical developments in the field, and the ability to transmit these developments to those who are directly concerned with production in the foundry. — **Reported by Donald Toland for Penn State.**

Research Results Topic At Canton-Massillon

Speaker: C. H. Lorig
Battelle Memorial Institute

C. H. Lorig, technical director, Battelle Memorial Institute and national treasurer A.S.M., spoke at a meeting of the **Canton-Massillon Chapter** on the "Fruits of Metallurgical Research".

Dr. Lorig spoke of the $5 billion invested in research in 1956 and the estimate that, on the average, in industrial research there is a return of $60 for each dollar invested. He presented numerous slides which illustrated that additional research is required to conquer the material barriers that are limiting progress in many engineering fields.

In steam turbine applications, for example, practicable designs are limited to below 1200° F. with the available metals such as stainless steel. The future foresees a substantial recession in this boundary with the development of today's research alloys of columbium, cobalt and molybdenum. These applications require elevated temperature strength accompanied by good fatigue resistance and resistance to both thermal shock and oxidation. One company has developed a nickel-cobalt alloy and another a nickel-base alloy, both of which are being used to increase the temperature limits of steam and gas turbine design.

Jet propulsion turbines are even more demanding than their steam turbine generator counterparts. Light weight is still an important characteristic of general aircraft design. Aluminum alloys will continue to find many applications in supersonic aircraft; however, as a basic structural material for such aircraft where skin temperature may rise above 400° F., they cannot compete with the best titanium alloys or stainless steel on a strength-weight basis. Research is in progress to provide new alloys of aluminum which will have both high-temperature strength and high-temperature stability. A sintered product containing a high percent of Al_2O_3 shows promise. An alloy of magnesium with thorium and zirconium also has excellent properties at temperatures up to 600° F.

Perhaps the most important property of today's aircraft constructional material is strength-with-stiffness. Tomorrow, with the advent of multiple "mach" numbers and the accompanying high "skin" temperatures, the prime characteristics of such materials will be strength and stiffness with elevated-temperature stability.

High-temperature scientific progress, as all scientific progress, is a direct function of the fruits of both applied and fundamental research.—**Reported by J. E. Fogarty for Canton-Massillon Chapter.**

Corrosion by Liquid Metals Discussed

William D. Manly Recently Addressed Members of the Los Alamos Chapter on the Subject "Corrosion by Liquid Metals". Shown are, from left: R. B. Gibney, technical chairman; W. N. Miner, chairman; Dr. Manly; and Daniel Pavone, program co-chairman. (Photo by E. M. Cramer for Los Alamos)

Speaker: William D. Manly
Oak Ridge National Laboratory

"Corrosion by Liquid Metals" was the title of a well-illustrated talk given at a meeting of the **Los Alamos Chapter** by William D. Manly, associate director, metallurgy division. Oak Ridge National Laboratory.

Dr. Manly described the principal types of liquid-metal corrosion and discussed the variables which affect each type. He listed several categories of tests used in connection with liquid-metal corrosion, and explained some of the techniques which have been successful. A review of test results followed.

An important present-day use of liquid metals is that of a heat transfer medium in reactors. In commenting on the requirements to be met in this service, Dr. Manly presented data on corrosion resistance of various materials to the liquid forms of sodium and lithium metals. —**Reported by H. L. Brown for Los Alamos Chapter.**

Tells How Radiation Affects the Human Body At Puget Sound Meeting

Speaker: R. D. Barer
Pacific Naval Laboratory

R. D. Barer, Pacific Naval Laboratory, British Columbia, presented a talk on the "Effect of Radiation Upon the Human Body" at a meeting of the **Puget Sound Chapter.** Mr. Barer stressed the point that, as yet, there is no definite knowledge of the amount and total effect of radiation. He did say, however, that original estimates of the degree of radiation that can be withstood without ill effects are continually being revised downwards.

Mr. Barer reviewed the general physiological and genetic aspects of radiation effects. He described the two basic types of radiation damage to any body cell. The first was chromozone aberration, which is a condition where a certain percentage of the damage can be corrected by normal replacement of deformed cells. However, extreme dosages may result in the formation of tumors. The second and more serious prospect is gene mutation. Mr. Barer stated that, as gene mutation may persist for as long as 40 generations, the problem is one which must be given thorough study. It has been established by geneticists that each person carries approximately eight mutant genes, and if this level of mutation were doubled, the effect upon the race would be disastrous.

Accepting this danger, the question then is what constitutes an overdose of radiation. Studies are in progress wherein the estimated dosage has been fixed in the range of 4-10 roentgen/30 yr. The problem is made more complex by the many ways in which an individual is exposed. Normal background radiation from the atmosphere and from materials constantly about us are sources which require analysis. However, the most serious source of radiation today is medical equipment. This condition is the result of ignorance on the part of the individual and abuse by the medical profession.

Mr. Barer's final statement was that "each generation is the trustee of the human race, and therefore, it is imperative that every effort be made to fully understand this problem of radiation before irreparable damage is done". —**Reported by C. M. Walker for Puget Sound.**

Explains Purpose of First Satellite

Rear Admiral Rawson Bennett, Chief of Naval Research, Gave a Talk on "Building and Launching the First Satellite" at the Ladies Night Meeting in Indianapolis. At the speaker's table were, from left: Mrs. and George J. Shubat; Admiral Bennett; and Mr. and Mrs. Ed Tuttle

Speaker: Rawson Bennett

United States Navy

Rear Admiral Rawson Bennett, Chief of Naval Research, presented a talk entitled "Building and Launching the First Satellite" at the Ladies Night meeting held by **Indianapolis.** Five high-school students who received A.S.M. Science Achievement Awards were special guests of the Chapter.

Admiral Bennett stated that during the next year a new object is scheduled to appear in the skies. It will be small and hard to see. Only those who know exactly when and where to look will be able to see it at all. But it will be circling through the heavens in its own orbit, like the moon and the planets. The big difference will be that this will be a heavenly body that man has fashioned with his own hands and placed in an orbit around the earth, the first artificial satellite.

This earth satellite will be a globe 20 in. in diameter. Inside will be some instruments for gathering scientific information. It will be raised to a height of about 300 miles above the earth by rockets and accelerated to a speed that will keep it circling around the earth once every 90 min. It may stay up for a day, a month, or a year.

This earth satellite project is part of a broad scientific program called International Geophysical Year. The I.G.Y. is a period of 18 months wherein 50 nations will join in a study of the sciences of the earth, its atmospheres and the space which surrounds it.

The I.G.Y. is being organized by the International Council of Scientific Unions. In the United States a special group known as the National Committee for I.G.Y. has been appointed by the National Academy of Sciences. They work with the government organization, the National Science Foundation, which has received money from Congress to parcel out to various participating groups.

The Department of Defense is supporting the I.G.Y. scientific program. It will provide manpower and material to operate and build observing stations, ships and aircraft for transportation, and floating bases for ocean operations. The Navy will be extremely active.

Scientists expect that this united effort will bring major breakthroughs in problems that involve our knowledge of the earth and the sun.

A large part of the planned I.G.Y. observations will concern the upper atmosphere and the sun. For many years scientists have been studying the upper atmosphere with high-altitude rockets and instrument-carrying balloons. These are good research tools and men have learned much with them, but balloons cannot go high enough and stay there for many hours while rockets can go much higher but cannot stay there.

There are many quantities that scientists would like to observe above the atmosphere continuously for long periods of time. The one method of doing this seems to be a permanent observation platform in space, a satellite in orbit around the earth.

The satellite program is called Project Vanguard. Rockets are the only means available to lift a satellite above the atmosphere and give it the tangential speed it needs to counteract the pull of gravity and stay in an orbit around the earth. The proposed satellite will be simply the pay load of a rocket fired in such a way as to stay above the atmosphere.

The satellite skin and its supporting frame work are to be made of a magnesium alloy which is very light and yet rugged enough to withstand the shock of powerful rocket firings. The skin will be about 1/30 in. thick, it will be completely smooth and will be polished to make it as shiny as possible so it will reflect light.

The Vanguard launching rocket will have three stages. The first stage will send the rocket aloft from the ground, then drop off and a second motor will fire. When this second-stage motor is spent, it, too, will drop off and the third-stage motor will fire and accelerate the satellite up to its orbital speed.

The satellite will be launched from the Air Force Missile Test Center at Cape Canaveral on the East Coast of Florida near Orlando.

The orbit will be an ellipse. The satellite's closest approach to earth is called perigee, about 200 miles. Its greatest distance from the earth is called the apogee, about 1500 miles. It will lose some energy each time it approaches perigee because of the drag of the earth's atmosphere. It is not known how long the satellite will stay up, because the density of the air at that altitude is not known.

Some results of the earth satellite program can be:

1. Better measurement of size and shape of the earth, and distances between points on the earth.
2. Measurement of the density of the atmosphere at that height.
3. Measurement of temperatures on the outside and inside of the satellite.
4. Measurement of the collisions of meteorites with the satellite.
5. Measurement of the ultraviolet and X-rays from the sun.
6. Measurement of the earth's magnetic field above the atmosphere.—**Reported by Dorothy Holbrook for Indianapolis Chapter.**

Speaks on Uses of Zirconium For Nuclear Applications

Speaker: Spencer Bush

General Electric Co.

Spencer Bush, in charge of physical metallurgical research at General Electric Co.'s Hanford Works, was the guest speaker at a recent meeting held by the **Vancouver Island Chapter.** He presented a talk entitled "The Use of Zirconium in Nuclear Applications".

Dr. Bush stated that the application of zirconium in nuclear engineering is one of the steps of a basic approach by research men to find a metal with the best all around properties for this project. He illustrated his talk with graphs and blackboard sketches.—**Reported by M. F. Gray for Vancouver Island.**

Speaks on PH Steels in North Texas

At a Meeting of the North Texas Chapter, Paul Ramseyer, Product Supervisor of Armco Steel Corp., Spoke on the "Latest Developments in Precipitation-Hardening Stainless Steels". Shown, from left: R. E. Hopper, treasurer; Mr. Ramseyer; A. S. Holbert, vice-chairman; and R. L. Wells, Armco

Speaker: P. E. Ramseyer
Armco Steel Corp.

North Texas Chapter members heard Paul E. Ramseyer, product supervisor, Armco Steel Corp., speak on "Latest Developments in Precipitation-Hardening Stainless Steels" recently.

Airframe materials for high-speed flight must be strong in relation to weight, able to retain much strength at flight temperatures, and be fabricable by accepted forming and joining methods. They must also be adaptable to production from available raw materials.

Titanium alloys and high-strength steels are the only materials being seriously considered for future volume aircraft and missile production. Among the high-strength steels, Armco pioneered in developing the precipitation-hardening stainless steels. They have been proved on a production basis since commercial introduction in 1948. New heat treatments and new precipitation-hardening steels promise still higher strengths at room and elevated temperatures.

The essentially austenitic, aluminum-bearing Armco 17-7 PH stainless steel is workable in the austenitic condition and hardenable by low temperature transformation and precipitation-hardening treatments. Relative ease in fabricating annealed 17-7 PH is due to this austenitic condition delivered by the mill. Its companion grade, Armco 17-4 PH, is a leaner alloy, which causes austenite to transform to martensite at about 200° F. when cooling down from annealing temperature.

In a new RH 950 heat treatment, recently developed for 17-7 PH stainless, heating for 10 min. at 1750° F. has replaced heating for 90 min. at 1400° F. used in the conventional TH 1050 treatment. Second-stage treatment requires cooling to −100° F. for 8 hr. rather than ½ hr. at 60° F. Final hardening involves heating for only 60 min. at 950° F. instead of 90 min. at 1050° F. The heat treatment for condition RH 950 insures an increase in tensile strength from 180,000 to 200,000 psi., or a gain of 11%. Gain in minimum 0.2% yield strength is from 150,000 to 180,000 psi., a 20% increase.

Armco 17-4 PH is used in bar form as components in instruments, power plants, motors, pumps and flap track fittings; also in engine supports, hydraulic units and landing gear assemblies. Armco 17-7 PH sheet and strip go into formed structural parts of airframes and missiles, such as ribs and stringers, tail assemblies, bellows, shrouds and honeycomb. It is serving well in hot areas of airframes at temperatures as high as 900° F. Honeycomb structures are composed of thin strip expanded into cellular form and covered with metallic skins. They have excellent stiffness properties for their weight.

Newest development is Armco PH 15-7 Mo stainless steel. Chromium content has been lowered 2% and molybdenum added in about the same amount. This improves mechanical properties in the elevated temperature range. Transformation and hardening by heat treatments are similar to those for 17-7 PH.

Armco also produces in bar form a precipitation-hardening alloy designated 17-10 P, developed for applications requiring high strength with low magnetic permeability. This alloy, 17-10 P, can be hardened by either single or double heat treatments and remains austenitic.

Recent developments indicate that addition of molybdenum to 17-4 PH improves its elevated temperature mechanical properties. Other combinations of chemistry are being studied and should develop alloys to meet the higher temperature requirements in the range from 1100 to 1400° F.

More liberal use of the PH steels is only beginning and their attractive properties should bring about a great increase in future material requirements.—**Reported by Bob Craft for North Texas Chapter.**

Clark Is Guest in Indianapolis

Donald S. Clark, California Institute of Technology, and National President A.S.M., Presented a Talk Entitled "Dynamic Properties of Metals" at the National Officers Night Meeting Held by the Indianapolis Chapter. Present were, from left: George J. Shubat, vice-chairman; Dr. Clark; Edward T. Tuttle, chairman; and Carl Weber, executive committee

Speaks on Welding of Stainless Steel

Shown at the Speaker's Table at a Meeting of Tulsa Chapter Held Recently Are, From Left: F. A. Dewey, Secretary-Treasurer; W. L. Smith, Program Chairman; H. F. Reid, Jr., Manager, Technical Service Division, McKay Co., Who Spoke on "Welding of Stainless Steels"; G. R. Clay, Chairman; and Mr. Robinson, Representative, McKay Co. (A. N. Stevens, Reporter)

Points Out Advantages Of Notch Ductility Tests At Chattanooga Meeting

Speaker: W. S. Pellini
Naval Research Laboratory

The **Chattanooga Chapter** recently heard a talk on the "Significance of Notch Ductility Tests to Metallurgists and Welding Engineers" by W. S. Pellini, superintendent of the metallurgy division, Naval Research Laboratory.

Mr. Pellini described cases of sudden catastrophic failures of large welded steel structures such as ships, storage tanks and pressure vessels. Indications of the seriousness of this problem were first evident in the collapse of welded bridges in Belgium during the late 1930's and the collapse of large storage tanks in this country. During the early years of World War II, a high failure rate of the new all-welded merchant ships was experienced. The seriousness of the situation demanded an all-out effort by designers, welding engineers and metallurgists to determine the cause and to establish solutions or remedial procedures.

The speaker provided a chronological account of developments from 1942 to present. The mid-forties was a period marked by investigations of the Charpy V characteristics of failure material which may be described as the search for a correlation between small laboratory notch tests and service experience. This work was fruitful and demonstrated that brittle fractures were initiated only at temperatures such that the Charpy V tests indicated values of less than 10 ft.lb. Since this time it has been established by work at the Naval Research Laboratory and further correlations with service failures that all steels do not obey the 10 ft.lb. rule. For certain classes of steels the critical correlation values are in the order of 15 to 30 ft.lb.

Another approach was to test large pieces of steel containing notches of various types to reproduce the failure conditions at the temperatures of failures in service. This approach was not fruitful until very sharp cracks were placed in the test plates. Work with brittle weld crack starting tests established the existence of a critical temperature, termed the nil-ductility temperature, below which the steel could be described as unable to deform in the presence of a sharp crack. This temperature was shown to be in correct correspondence with the failure temperatures of the ship steels and a wide variety of non-ship failures, such as pressure vessels. The sharp crack approach was further exploited successfully in the Robertson test (England) and in the S.O.D. test (U.S.A.). These tests were successful in predicting crack stopping temperatures; that is, temperatures above which fractures could not propagate in material stressed within the elastic range.

Mr. Pellini explained that the results of these investigations have been fitted into a general scheme which defines the role of design, welding and materials in the problem of brittle fracture. Temperature, as a new parameter of design, must be recognized as basic to this problem. The lesson of the wartime ships —that a design which is safe for operation of the ship at summer temperatures may be unsafe for winter temperature operation—must be accepted as a guide in the future, if the steels show a notch ductile to notch brittle transition in this temperature range. The designer should thus be concerned with questions of the notch ductile to notch brittle transition characteristics of steels as related to the expected service temperature range.

The role of the metallurgist is now clear; the properties of the steels must be modified (within certain restrictions of economics) so that the notch ductile to notch brittle transition is below that of the expected service temperature. If the metallurgist succeeds, the designer's task is greatly simplified; conventional design concepts may be applied with safety. If steels of adequate notch ductility are not available, great attention to design details is mandatory in order to lower the *probability* of failure to acceptable levels. The significance of the ductile to brittle transition temperature range is that above this range the probability of brittle fracture is removed, while below this range the probability is always finite. That is to say, below the transition temperature, design aspects serve only to alter the probability of failure.

The role of welding is now clear also, although less definable than in the case of metallurgy. Welding may contribute notches, cracks or other flaws from a variety of causes. The presence of such notches or flaws at points of high stresses in steel of inadequate notch ductility is the combination which leads to the "brittle fracture problem".—**Reported by J. H. McMinn for Chattanooga.**

New Films

Automation in the Metallurgical Laboratory

Buehler, Ltd., takes you on a 30-min. trip through a modern metallurgical laboratory, via a 16-mm. sound and color film, for a demonstration of modern methods of metallurgical sample preparation including cutting, grinding, mounting, automatic fine grinding and polishing, electrolytic polishing, etching, cleaning and microscopic examination.

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Zinc Controls Corrosion

The American Zinc Institute presents "Zinc Controls Corrosion", a 38-min. film showing the general mechanism of corrosion and how zinc controls it.

The 16-mm. sound and color film illustrates the fundamental nature of corrosion, methods of coating steel with zinc, production of galvanized steel, and fabrication of articles from galvanized sheet and strip.

Available to technical societies, scientific groups, industrial organizations and educational institutions, the film may be borrowed from Rothacker, Inc., 729 Seventh Ave., New York 19.

A.S.M. Members' Names Added to Quarter Century Club Roster

The following A.S.M. members have been awarded honorary certificates commemorating 25 years consecutive membership in the Society:

Boston Chapter—Medio A. Pederzani, Reece Corp.

Buffalo Chapter—Gerard E. Claussen, Reginald V. Williams, Otto W. Winter.

Canton-Massillon Chapter—Donald S. Klippert, R. J. Perrine, Glen H. Rearick, Wilbur E. Warne.

Carolinas Chapter—A. D. McNutt

Chicago Chapter—Charles S. Hegel, Robert J. Murphy, C. T. Prendergast, Cyril Stanley Smith, Arthur W. Stolzenberg, E. A. Terwell, Elbert D. Tripp, T. O. Westhafer.

Chicago-Western Chapter—R. M. Brick, M. F. Surls.

Cincinnati Chapter—John B. Caine, Carl O. Graves, Metal Specialty Co., Sawbrook Steel Castings Co.

Cleveland Chapter—W. K. Bock, Columbia Tool Steel, Walter A. Dean, James T. Gow, S. V. Jablonski, Paul E. Jerabek, G. H. Kaiser, Frank W. Masterson, Frederick H. Meng, John F. Occasione, Edward E. Whiteside.

Columbus Chapter—Lloyd R. Jackson.

Detroit Chapter—Ira S. Latimer, Leo J. Lesperance, William E. McCullough, Walter E. Peterson, L. C. Berkey.

Golden Gate Chapter—General Metals Corp.

Indianapolis Chapter—Louis Z. Smitz.

Lehigh Valley Chapter—John S. Worth.

Los Angeles Chapter—H. U. Baker, George A. Gallagher, P. D. McElfish, Herluf P. Nielsen, Turner C. Smith.

Mahoning Valley Chapter—Robert M. Clevenger, Wilson Scott.

Minnesota Chapter—Herbert H. Blosjo, Howard F. Eilers, Wilber G. Somes.

Montreal Chapter—L. P. Brady, Canadian Allis-Chalmers Co., Canadian Liquid Air Co.

Muncie Chapter—Rodney G. Hayler, Alvin W. Holmes, Paul R. Judy.

International Chapter—Arthur S. Reardon.

New Haven Chapter—Jesse B. Burton, J. Erler.

New Jersey Chapter—Gerald G. Kelly, Bruno Marsilio, John W. Queen.

New York Chapter—Janet Zaph Briggs, Anthony W. Deller, C. M. Schwitter.

Notre Dame Chapter—Walter G. Fassnacht.

Oak Ridge Chapter—John H. Frye, Jr.

Ontario Chapter—John Bertram & Sons Co., Ltd., Canadian General Electric Co., Ltd.

Philadelphia Chapter—Hill-Chase & Co., W. C. Murray.

Pittsburgh Chapter—F. C. Braun, William C. Masters, Kenneth Midlam, Henry D. Monsch, E. C. Ray, Universal-Cyclops Steel Corp., William H. C. Webster, Robert T. Wood.

Toledo Chapter—Rowland F. Hill, Victor E. Zang.

Utah Chapter—A. P. Hoelscher.

Washington Chapter—C. S. Aitchison, Homer O. Dahlke, C. E. Pond.

West Michigan Chapter—O. C. Schultz.

Wilmington Chapter—James A. Collins.

York Chapter—Robert Chestnut, Paul D. Strubhar.

Discusses Nodular Iron At Cedar Rapids Meeting

Speaker: W. W. Edens

Allis Chalmers Manufacturing Co.

"Nodular Iron" was the topic discussed at a meeting of the **Cedar Rapids Chapter** by W. W. Edens, supervisor of melting metallurgy section, research laboratories, Allis Chalmers Manufacturing Co.

Mr. Edens discussed some of the structural differences between cast and nodular iron. He pointed out how the typical flake graphite structure affects the physical properties of cast iron, and how these properties are enhanced by the nodular structure.

Details of some of the extensive research on nodular iron were outlined. The nodular iron is most commonly produced with the use of magnesium additives to the cast iron, but many other additives have been investigated. Nodular iron also has been produced with calcium and sodium salts and many of the alkaline earths. These additives are not, however, as effective as the magnesium addition.

Although it is not exactly known why magnesium will produce the nodular graphite formation, it has been shown that it does do the job easier and less expensively than other additives that have been tried. The greater solubility of magnesium extends the stability of the iron in the ladle, and allows it to be held longer and still produce a good nodular iron.

To produce nodular iron it is necessary to have a low-sulphur iron and the sulphur must be controlled closely as it cannot exceed the magnesium content. Nodular iron has been described as a high-silicon steel with graphite in the structure and having good machinability.

Typical microstructures, views of manufacturing processes, and various parts produced in nodular iron were illustrated with slides.—**Reported by F. C. Gieseking for Cedar Rapids.**

Discusses Steelmaking At Meeting in Ontario

Speaker: Karl L. Fetters

Youngstown Sheet & Tube Co.

At a recent meeting of the **Ontario Chapter**, Karl L. Fetters, assistant vice-president of the Youngstown Sheet & Tube Co., and A.S.M. national trustee, presented a talk entitled "Steelmaking, Production and Research".

Dr. Fetters covered the whole field of steelmaking, tying in the entire processing, from raw materials, their ability, to various refining methods.

K. L. Fetters

Recent developments in steelmaking, such as the oxygen or L.D. process, were discussed, together with the research underway in the different phases of steelmaking, present trends and probable future of the industry.

Throughout the presentation, Dr. Fetters stressed the point that the industry must show profits in order to afford research and then to be able to install the equipment required as a result of this research, in order to remain competitive and show profits.

The interesting talk was well received by an exceptionally large audience. Since this was Ontario Chapter's official "Buffalo Chapter Night" the officers of the Ontario Chapter were pleased to welcome 56 visitors from Buffalo, led by Buffalo chairman, M. N. Hayes of Canadian Westinghouse, Buffalo.

A total of 147 members and guests attended the meeting.—**Reported by V. G. Behal for Ontario.**

Buffalo Holds Dance

Over 300 members and guests attended the annual supper dance meeting of the **Buffalo Chapter** which was held at the Trap and Field Club. The dance was preceded by a Hospitality Hour sponsored by the sustaining members of the chapter.—**Reported by G. F. Kappelt for Buffalo Chapter.**

Canadians Receive Science Awards

The Canadian Science Achievement Award Winners in the 1956 Contest, Together With Their Instructors and High-School Principals, Were Guests of the Western Ontario Chapter for the Celebration of the Tenth Anniversary of the Chapter's Founding. Shown are, from left: B. J. Blair, chairman; George F. Dean, principal, W. D. Lowe Vocational School, Windsor; Orest Dzis, honorable mention award; Alex Radovich, national award winner; Gino Pavan, honorable mention award; and L. F. McGee, head of the science department, W. D. Lowe Vocational School. John Azlen, who also won a national award, was unable to be present at this meeting

Physical Metallurgy Is Columbus Subject

Speaker: E. S. Rowland
Timken Roller Bearing Co.

E. S. Rowland, chief metallurgical engineer, Timken Roller Bearing Co., presented a talk entitled "Practical Application of Physical Metallurgy" at a meeting of **Columbus Chapter.**

Dr. Rowland's talk covered three particular problems and how metallurgical research was applied to solve them. The first problem concerned the spheroidize-annealing of SAE 52100 steel. It was pointed out that several thousand tons a month of this high carbon alloy steel must be produced to exacting standards. Since most of the steel goes into bearings, the hardness and structure must be closely controlled to meet high production machining and heat treating schedules. Spheroidal carbide of definite size and distribution must be produced by a long annealing process. If this time could be shortened, even by a small amount, a considerable saving could be achieved. Research shows that the time and temperature relationship is very important in the region just above the A_1 temperature. Heating rates of about 10° F. per hr. and cooling rates up to 20° F. per hr. through the critical are found to be best. Rapid heating can be used up to about the A_1 temperature. The length of the annealing cycle has been shortened somewhat as a result of applied research.

The second problem dealt with the Jominy end quench test and the various factors which affect its reproducibility. Lack of agreement in Jominy results occurs not only between different laboratories but within individual laboratories on what is supposedly identical material. To resolve these difficulties, a number of carefully controlled experiments were performed. Jominy bars with as many as eight thermocouples spaced along the length of the specimen were heated in neutral atmospheres and quenched under controlled conditions. Cooling rates at various positions along the bar were recorded with a high-speed oscillograph. This testing disclosed that such things as transfer time, drafts in the laboratory, and getting the specimen cocked in the fixture, were important variables. Taking care to control these variables resulted in excellent agreement time after time. Such factors as water temperature, water height, and the presence of a light scale were relatively unimportant.

The third problem discussed was that of residual stresses in hardened steel parts, specifically, hardened bearing components. Roller bearings generally fail by spalling after an indeterminate time, although most bearings have a relatively long life, a few fail prematurely. There has been some thought that residual stresses may be related in some way to failure by spalling. The measurement of residual stresses by traditional methods is a long and tedious operation. Because of this, a program of research was applied to this problem and it resulted in the development of a rapid X-ray method of determining residual stresses in the surface layers of hardened steel parts. Using this method, it was found that 0.006 in. of stock removal by an OD grinding operation increases the compressive stress in the surface of the part from about 10,000 to 40,000 psi. This is a very shallow effect extending to a depth of perhaps 0.002 in. and can be removed by an electrolytic polish. The effects of the normal heat treating variables on residual stresses were found to be relatively slight. To date, no definite relationship has been found between residual stresses and incidence of failure by spalling. **—Reported by L. P. Rice for Columbus Chapter.**

Points Out Tricks of Machine Shop Practice

Speaker: James T. Ferri
F. F. Slocomb Corp.

James T. Ferri, president of the F. F. Slocomb Corp., spoke before the **Savannah River Chapter** on the subject "Machine Shop Practices—Some Tricks of the Trade".

Mr. Ferri pointed out that in order to meet competition in today's market the special machine builder and fabricator must rely upon his experience far more than upon technical knowledge. The basic cutting speeds of metals have been established, therefore the actual machining time is essentially the same for any manufacturer, but by employing various methods, manufacturing costs can be reduced.**—Reported by A. B. Thomas for Savannah River.**

Talks on Machinability At Meeting in Milwaukee

Speaker: F. W. Boulger
Battelle Memorial Institute

Francis W. Boulger, chief, ferrous metallurgy division, Battelle Memorial Institute, presented a lecture in **Milwaukee** entitled "Metallurgical Aspects of Machinability".

Mr. Boulger discussed the methods used at Battelle to evaluate the machinability of various materials. One method used extensively is the constant pressure lathe test in which the tool is fed into the workpiece at a constant force. Results have indicated that 98% of the work done in machining was expended in the form of heat, that tool-face temperatures averaged about 1400°F., and that the addition of sulphur or lead to a low carbon steel and lowering the carbon and silicon content of B1113 steel increased machining rates.**—Reported by Donald P. Kedzie for the Milwaukee Chapter.**

Presents Discussion on Uses of Oxygen in Steelmaking Processes

Speaker: J. K. Stone, Jr.
Kaiser Engineers

"Uses of Oxygen in Steelmaking Processes" was the subject of a talk given by J. K. Stone, Jr., Kaiser Engineers, at **Penn State.**

Oxygen is an extremely important material in all stages of pig iron and steel production from the coke oven to the blast furnace, the open-hearth and the oxygen converter process. The steel shortage following World War II was one cause of the rapid development in the use of oxygen in steelmaking.

An ordinary blast furnace uses up to 3500 tons of air in the production of 1000 tons of pig iron. The conventional blast furnace cannot use pure oxygen, but experience has shown that as little as 1½% oxygen enrichment, together with controlled additions of steam to the blast, will increase iron production by 7%.

Oxygen-enriched air has been used in openhearths to accelerate combustion and scrap melting. Up to 13% increased production has been attained by this method.

Oxygen for decarburizing of open-hearth heats has been used in many different ways at different plants. The speaker described in some detail the PT oxygen gun used at Steel Co. of Wales for blowing oxygen into the openhearth with a water-cooled lance. The method permits faster removal of carbon so that 5 to 8% increased production is realized on low carbon heats.

Mr. Stone presented an excellent color film of steel production by the oxygen converter process at Donawitz in Austria. The process utilized high-purity oxygen for rapid conversion of liquid pig iron and solid scrap to steel. The rapidity and simplicity of the process permits major savings in plant investment and operating costs. The steel produced is comparable to that produced in the open-hearth and can be made even lower in nitrogen than openhearth steels. These low-nitrogen steels are extremely resistant to aging and are more easily formed than the higher nitrogen grades.

Kaiser Engineers, as a major engineering and construction firm, is a leader in the development of the oxygen converter process in this country. In offering the process to the U.S. steel industry it is expected that steel producers will be able to consume a wider variety of pig irons and produce high carbon steels, low-metalloid ingot iron and a wider variety of low alloy steels.

The Kal-Do converter process as used in Sweden was described. This process has, up to now, been used to convert high-phosphorus hot metal to steel. Another development, the Cyclosteel Process, is under investigation in England. In this process, heated ore, oxygen and powdered coal are blown into a chamber where they react to form steel and slag. The British Iron and Steel Research Association indicates that the process is in the early stage of development.—**Reported by Donald A. Toland for Penn State.**

Describes Solidification of Metals

W. S. Pellini, Superintendent of the Metallurgy Division, Naval Research Laboratory, Spoke on the "Solidification of Metals" at a Recent Meeting of the Cleveland Chapter. Shown are, from left: Edward Dyble, Chairman; Mr. Pellini; and Charles W. Briggs, Steel Founders' Society of America

Speaker: W. S. Pellini
Naval Research Laboratory

William S. Pellini, superintendent of the Metallurgy Division at the Naval Research Laboratory, presented a talk before the **Cleveland Chapter** on the "Solidification of Metals".

Mr. Pellini described the thermal analysis method for investigating the mechanism of solidification of metals. This method involves the use of thermocouples spaced through the section of the solidifying metal. The cooling curve data obtained for these various spatial positions are used to establish the timing of the start and completion of solidification at various distances from the mold wall. These studies have shown that solidification of all metals proceeds in a wave-like fashion by the travel of "start" and "end" of freeze waves across the section from surface to thermal center. For any given metal, the thermal characteristics of the mold walls determine the rate and mode of travel of these waves. For example, in the case of steel, chill walls which remove heat at high rates result in the travel of these waves in conjunction and with narrow distance separation, thus resulting in a "narrow band" or progressive solidification. Conversely, sand walls which extract heat at relatively low rates (low heat diffusivity) result in the travel of the start of freeze wave to the center before the end of freeze wave begins its travel from the surface. This mechanism of separate travel of the two waves result in a "broad band" and general solidification mode.

Mr. Pellini further explained that the thermal characteristics of the solidifying metal also affects the relative movement of the two waves.

Metals which have high-thermal conductivity and broad liquidus to solidus temperature ranges tend to develop very "mushy" or broad band freezing even with molds of relatively high heat diffusivities. The speaker demonstrated these relationships for a wide variety of metals and explained that it is possible to predict the solidification mechanism of metals from considerations of their thermal constants, phase diagram features, and the mold wall thermal properties.

With this introduction, the speaker proceeded to discuss the effects of shape on freezing rates as being determined by the geometric ratio of surface area of heat removal to volume of metal to be solidified. These relationships form the basis for new scientific methods for establishing the size of feeders or risers required for castings. The relationships of freezing mode of a metal to its foundry characteristics were explained. Metals which freeze with wide band solidification are inherently difficult to handle because of the tendency to form dispersed shrinkage resulting from the inherent difficulty of developing adequate feed metal flow in such cases. Metals which freeze in narrow band fashion are relatively easy to handle by the use of risering and feeding range rules.

Final discussion centered on the specific characteristics of steels, bronzes, aluminum alloys, stainless steels and irons.—**Reported by J. J. Glubish for Cleveland.**

Meet Your Chapter Chairman

MONTREAL

ARNOLD H. BOEHM, a native of Bohemia, received his degree in mechanical engineering from the University of Prague.

In his student days he was an enthusiastic oarsman and canoeist, and saw a great deal of Europe. He owned a business and plant, but emigrated with his wife to Canada when war appeared imminent in 1939. He joined the engineering department of the Steel Co. of Canada in Montreal, and was supervisor of the welding electrodes department during the war. In 1946, he was appointed chief engineer, Montreal Works. He has been a member of A.S.M. since 1946, was elected to the executive committee in 1949, and served as honorary treasurer from 1952 to 1954.

He is a member of the Corporation of Professional Engineers of Quebec, the Engineering Institute of Canada, and the Association of Iron and Steel Engineers.

WASHINGTON

NATHANIEL C. FICK, metallurgical engineer, Office of Defense Mobilization, Executive Office of the President, was born on a farm at Lake Wawasee, Ind. He holds degrees from Butler and Purdue Universities. He held a variety of part-time jobs during the summers of his college years, including welding, work as a typist, manager of a summer resort, National Park Service and in tire survey at the Indianapolis Speedway on race day. He also served as graduate assistant in metals and alloys, and as a metallographer at Purdue.

His first job out of school was as metallurgical assistant in sheet and tin mills and he moved on through research assistant, metallurgist, then took a job on the technical staff at Battelle Memorial Institute. He left his job to go to Washington where he served in many capacities, including physical sciences administrator in the office of the chairman of the Research and Development Board, and director of the Metals and Minerals Panel before joining the Office of Defense Mobilization.

Nat and his wife Margaret, and their six children, five girls and a boy, live in Arlington. Spare time is devoted to civic and educational activities, and occasionally fishing, golfing and sailing. He has been active in flying, and holds a private pilot's certificate.

PHOENIX

WILLIAM E. TAYLOR was born in Worland, Wyo., and received his B.S. and Ph.D. degrees from Purdue University. His first job after leaving school was at Oak Ridge National Laboratory in radiation damage research, and he is now associated with Motorola, Inc., as chief metallurgist and head of materials group in research and development, semiconductor plant.

Mr. Taylor has served as treasurer and vice-chairman of the Phoenix Chapter. From 1943 to 1946 he served in the armed forces as first lieutenant in the Field Artillery. He is married and has one son. For relaxation he enjoys painting and philosophy.

LONG ISLAND

WILLIAM W. ROGERS, born in Brooklyn, N. Y., is a graduate of Cornell with M.E. and M.S. degrees. After working as assistant chemist and a customer and standards engineer, he is now head of the department of mechanical technology, Long Island Agricultural and Technical Institute.

When Mr. Rogers went to Farmingdale there were no societies or technical meetings. He organized a series of dinner-technical meetings with prominent speakers and through these meetings developed a chapter of A.S.T.E. He was also instrumental in forming the Long Island Chapter A.S.M. He is the author of three text books and has written articles for technical magazines and also does consulting work on text books.

He has two daughters and his principal hobby is working at his cottage on Skaneateles lake, golfing when possible, fishing and gardening.

ST. LOUIS

A native of Wheaton, Ill., HERBERT A. BALL graduated from Wheaton High School and the University of Chicago, after which he took special work at Lewis Institute in Chicago.

Herb has been with the Olin Mathieson Chemiacl Corp. since 1946 when he started as a metallurgist. He received promotions to assistant chief inspector, chief inspector, quality control superintendent, quality control manager and recently to special test superintendent of the recently created Nuclear Fuel Division. Before joining Olin Mathieson, he was with Dallas Brass and Copper as chemist, then with Revere Copper and Brass Inc. as chief chemist and metallurgist, and later as supenintendent of methods.

Herb is a member of the American Society for Quality Control and the American Institute of Mining and Metallurgical Engineers.

Mr. Ball is married and has two children. He has been active with Boy Scouts of American as a scout master and explorer adviser, and is a member of the Board of Education, Roxana, Ill.

ROCKFORD

DONALD A. CAMPBELL, vice-president, engineering and research, Eclipse Fuel Engineering Co., was born in Zitacuaro, Mexico. He completed his education in the engineering school of the University of Colorado with a degree in electrical engineering. His first job was with H. L. Dougherty & Co., where he spent about 12 years in various engineering and sales capacities, with a 15-month leave of absence which he spent in the Army Signal Corps during World War I. He has been a New York district representative for Wheelco Instrument Co., as well as manager of the division specializing in gas combustion equipment for Bryant Heater Co.

Mr. Campbell has been active in the New York and Cleveland Chapters A.S.M. and is a member of A.G.A., Midwest Industrial Gas Sales Council, Industrial Gas Equipment Division G.A.M.A., and the Advertising Club of N. Y. He has a son and daughter.

A. H. Boehm *W. W. Rogers* *N. C. Fick* *W. E. Taylor* *H. A. Ball*

Specifies Material Requirements for Tin Cans at Baltimore

Speaker: R. R. Hartwell
American Can Co.

R. R. Hartwell, assistant to manager, Technical Service Division, American Can Co., spoke on "Material Requirements for the Tin Can" at a meeting of **Baltimore Chapter.**

The container industry produces about 250 cans per person per year or a total of some 40 billion cans annually. There are thought to be nearly 2000 separate uses for cans but the largest is beer for which eight billion cans were made last year.

Many materials enter into container manufacture but the principal one is tin plate. In addition to the obvious need for good appearance, formability and solderability, tin plate must accept a large variety of organic coatings and the surface is expected to remain stable. Tin plate is relied upon for container strength and corrosion resistance, with the tin having the function of providing electrochemical protection to the steel base. It is also expected tin plate will be available in various coating weights. Most tin plate is made electrolytically and the amount of tin per unit area is now a little more than one third that used prior to World War II.

For tin plate to perform satisfactorily its properties must be controlled to a degree unsuspected by the average person. For example, the protective film produced by chemical treatment of the tin surface has been calculated to be about 1×10^{-7} in. thick; the proper amount of lubricant on the surface is about twice that. Most electrolytic plate has a 0.0000015-in. coating on a side and the variation expected is only a small fraction of this.

The most important single part of tin plate is the steel which provides the can with the strength to resist deformation from vacuum or pressure and determines corrosion resistance. Four compositions of steel have come into use to provide the best balance between these properties and economic factors. Phosphorus and temper rolling is used to help obtain high strength; the more corrosion resistant steels are characterized by low phosphorus and residual metal contents.

The steel chosen for corrosion resistance depends on the specific use but other factors than composition can affect its importance. For some purposes the structure is equally important and more recently the nature of the steel surface has been found to have a pronounced influence for many tin plate uses. One of the characteristics falling in the last group is the so called "pickle lag" effect (the length of time required for a steel to attain a steady rate of solution in acid). The thickness of this affected layer, produced by oxidizing influences during annealing, is expected to be less than 0.0000010 in. and provides a final example of the control exercised over tin plate manufacture. — **Reported by G. M. Hinton for Baltimore.**

Briefs Boston on Corrosion Control

Shown at a Recent Meeting Held in Boston Are, From Right: Dan Cushing, Technical Chairman; Herbert H. Uhlig, Who Spoke on "Modern Trends in Corrosion Control"; H. Stuck, Chairman; H. W. Besse, Coffee Speaker; R. Pomfret, Program Chairman; and S. Demirjian, Executive Committee

Speaker: H. H. Uhlig
Massachusetts Institute of Technology

At a meeting held by the **Boston Chapter,** Herbert H. Uhlig, Massachusetts Institute of Technology, spoke on "Modern Trends in Corrosion Control".

With the effective use of slides, Dr. Uhlig discussed the advantages and disadvantages of various types of metals when exposed to corrosive media. He explained the nature in which the corrosion action takes place and the modern developments that can be used to combat corrosion. He touched upon some of the stress-corrosion and corrosion-fatigue problems encountered in the aircraft, chemical and marine industries. Dr. Uhlig pointed out the advantages of using shot peening and inhibitors as a means of preventing or decreasing the rate of corrosion. He also discussed the composition of materials as related to their effect on corrosion. He mentioned that the gas lines from Texas to the other areas of the country are cathodically protected to prevent rapid corrosion and should make the lines last indefinitely, thus making it feasible to transport gas.

He also talked about the trends in using coatings on metals to prevent corrosion. Among the new alloys developed, he mentioned Hastelloy F, which is used in the paper industry for corrosion resistance in contact with caustics.

Dr. Uhlig concluded by noting the trend in industry to utilize effectively the services of a corrosion engineer to combat corrosion problems.—**Reported by S. G. Demirjian for Boston.**

Talks on High-Temperature Aircraft Metals Reactions

Speaker: Alan Levy
Marquardt Aircraft Co.

Members of the **San Fernando Valley Chapter** heard Alan Levy, supervisor of the materials and processes section, Marquardt Aircraft Co., discuss the "Performance of Materials at Elevated Temperatures for Aircraft and Missile Applications".

The use of materials in aircraft and guided missiles at temperatures ranging from near room temperature to beyond the melting points of many metals has introduced a new concept in materials engineering.

A review of the various classes of materials that can be used at elevated temperatures was presented. These materials range from the standard ferrous and nonferrous alloys long familiar to the aircraft metallurgist to new alloys which are not yet commercially available. A comparison of properties in the temperature range from 200°F. to in excess of 3000°F. was made for aluminum alloys, magnesium alloys, alloy steels, titanium alloys, stainless steels, molybdenum alloys and nonmetallic refractories. The discussion was illustrated with the use of numerous slides and was based on a resume of recent data on the various materials as well as results of investigations at Marquardt.—**Reported by R. P. Frohmberg for San Fernando Valley.**

Fatigue Studies Described in Jersey

"Fatigue Studies" Were Described at a Meeting of the New Jersey Chapter by John H. Redfern, Jr., Curtiss-Wright Corp. Shown during the meeting are, from left: J. J. Hauptly, chairman; Mr. Redfern; Oscar O. Miller, technical chairman; and Stanley G. Lindstrom, vice-chairman of the chapter

Speaker: John H. Redfern, Jr.
Curtiss-Wright Corp.

John H. Redfern, Jr., Propeller Division, Curtiss-Wright Corp., spoke on "Fatigue Studies" at a meeting held by the **New Jersey Chapter.**

Mr. Redfern pointed out that, since aircraft parts are designed to save weight, extremely accurate fatigue data are desirable. Tests were made with large numbers of 4340 R. R. Moore specimens to obtain statistical data. When these tests showed considerable scatter, especially at stresses near the endurance limit, the specimens were examined critically to determine the cause of the scatter. It was found that the scatter in results was due to variations in the size of inclusions observed at the origins of failure. This relationship was demonstrated by a series of curves which related inclusion size to fatigue strength at various tensile strength levels.

At stress levels much higher than the endurance limit, inclusion size could not be correlated with fatigue strength because, instead of a single origin of failure, several origins were observed on the fracture surfaces. Mr. Redfern showed charts which illustrated that the occurrence of multiple origins or nuclei coincided with a reduction in the appearance of off-center fractures of the specimens. At low stress levels, off-center breaks occur because of the relatively small number of large inclusions present at random in the fatigue samples. At high stress levels, multiple failures are nucleated by the larger number of inclusions of sufficient size, and failure occurs at the center of the test sample.

Mr. Redfern presented data, comparing the effect of conventional versus special heat treatment, on fatigue failure of 4340 steel heat treated to 230,000 p.s.i. tensile strength. It was indicated that the heat treating practice had no significant effect.

It was shown that vacuum melting is of some value in increasing average fatigue strength at low stress levels for both 4340 and 52100 steels. However, occasional large inclusions in the vacuum melted materials increased the scatter of fatigue strength. At higher stress levels, sufficient inclusions of the required size are present, even in vacuum melted metal, so that failure is not inhibited. Likewise, vacuum melting is of no value in preventing notch fatigue failure.

Mr. Redfern showed some very interesting micrographs tracing the origin and propagation of fatigue cracks. It was shown that cracks start very early in the life of a specimen and propagate slowly at first and rapidly near final failure.

Although inclusions are the most important metallurgical characteristics causing fatigue failure in these R. R. Moore specimens, it was pointed out that, in actual parts, there are other factors of even greater importance. Mr. Redfern showed some fatigue failures of actual parts, which originated from sharp notches, tool marks, fretting and galling and electric etch marks. Other factors which could reduce fatigue strength were mentioned, including plating, corrosion and residual tensile stresses. **—Reported by A. M. Miller for New Jersey Chapter.**

Akron Hears Discussion On Electrode Coatings

Speaker: H. F. Reid
McKay Co.

H. F. Reid, Jr., manager, technical service division of the McKay Co., spoke on the general features of electrode coatings and the problems of welding stainless steel in a talk entitled "It Isn't Mud" in **Akron.**

G. T. Chiurazzi, U.S.M.C. Reserve, and chemist at Goodyear Aircraft Corp., presented official Marine Corps combat films of the First Marine Division in Korea.—**Reported by Carl Dorosa for Akron Chapter.**

MEN OF METAL

J. H. Whelan has been appointed manager of warehousing, with headquarters in Pittsburgh, and Paul P. Hubert was named assistant manager in charge of warehouse inventory, also in Pittsburgh, for Crucible Steel Co. of America. Mr. Whelan has been with Crucible for over 33 years, Mr. Hubert has been with the Company since 1952.

Howard C. Holmes, an executive of the Kaiser Aluminum & Chemical Sales, Inc., in Chicago, has been appointed director of the Aluminum and Magnesium Division of the Business and Defense Services Administration, U. S. Department of Commerce. Mr. Holmes is on loan from his corporation under the rotation system whereby experienced industrial experts volunteer their services for periods of six months or longer without compensation from the government.

Arthur K. Watson, president of IBM World Trade Corp., has been elected to the board of directors of American Brake Shoe Co. He is also director of the Niagara Fire Insurance Co., Fidelity & Casualty Co. of New York, New York Trust Co. and other organizations.

CLARENCE ZENER has been appointed director of the Westinghouse Research Laboratories. He assumes his new post after five years as associate director and a year as acting director of the 800-member staff of the laboratories.

Ipsen Industries, Inc., announces the appointment of J. ROBERT KELLER as Canadian sales manager for Ipsen automatic heat treating furnace and related process equipment. He will make his headquarters at the plant of Ipsenlab of Canada in Toronto.

ROBERT J. KIEFER has been appointed sales representative in Chicago for Laclede-Christy Division of H. K. Porter Co., Inc. He was formerly district works manager of fire brick production.

RALPH HAYDEN, JR., has been appointed manager of purchases and traffic by Foxboro Co. He succeeds RICHARD M. KIMBALL who will serve as consultant on procurement problems to the vice-president in charge of manufacturing.

HENRY B. KOEHLER, having completed an intensive training program in electroplating and allied processes, has been appointed electrical sales engineer for Hanson-Van Winkle-Munning Co. He will concentrate on the engineering and sale of motor generator equipment for the metal finishing industry.

MEN OF METAL

FRED KOELBLE has been named staff assistant for Pennsalt Corrosion Products. He will assist in handling orders, quotations and specifications on the Pennsalt line of acid proof cements used in bonding acid proof brick and tile.

MERLE W. KREMER has been appointed general manager, parts division, Sylvania Electric Products, Inc. His office will be at division headquarters in Warren, Pa.

PAUL KUNZ of General Electric's Metallurgical Products Department, Detroit, has been appointed component sales representative in the Texas area. He has been sales representative for G.E.'s carbide tools in the Flint, Mich., area.

DANIEL A. PORCO, controller of Crucible Steel Co. of America since 1955, has been appointed to the newly created position of manager-development. C. H. LIBBY, assistant controller, will succeed Mr. Porco as controller.

ELLIOTT D. LINTON has been named assistant manager of Norton Co.'s new distributor sales promotion department. He has had a long career with the company dating back to 1920.

HOWARD A. LITTELL, who has had many years of experience in the brass and aluminum mill products field, is in charge of the new branch sales office which Scovill Manufacturing Co. is opening in Pittsburgh.

CHARLES P. LUCKIE has been appointed district manager for the Federated Metals Division, American Smelting and Refining Co. He will be responsible for sales and services in Minnesota, North and South Dakota, with headquarters in Minneapolis.

RUSSELL P. MAHAN has been appointed vice-president in charge of purchasing at Baird-Atomic, Inc., Cambridge, Mass. He had been director of purchases for the company since 1942.

WILLIAM J. MARTIN, prominently identified for many years with abrasive service and sales work, has been appointed district manager for Michigan Abrasive Co. in the Cleveland-Columbus-Pittsburgh area, with headquarters in Detroit.

KENNETH E. MCKOWN is now product manager, Class I steel products and special shapes, Firth Sterling, Inc. This will be in addition to his responsibilities as superintendent of the tool bit department.

California Meeting Features Chromium

Present at a Joint Meeting of the Santa Clara and the Golden Gate Chapters Were, From Left, Standing: R. M. Beard and W. Ericksen; and Sitting, Bob Ray; Rodger D. Moeller, the Speaker; W. M. Matheson, Golden Gate Chairman; and R. Parkinson, Santa Clara Chairman. Mr. Moeller, Spar-Tan Engineering Co., spoke on "Chromium—the Metal and the Surface"

Speaker: R. D. Moeller

Spar-Tan Engineering Co.

At the organizational meeting of the new **Santa Clara Chapter** held jointly with the **Golden Gate Chapter**, R. D. Moeller, plant manager of Spar-Tan Engineering Co., gave a talk entitled "Chromium—the Metal and the Surface".

Chromium was discovered in 1797 but it was not until the early 1920's that commercial use of the pure metal was attained. The commercial use of the pure metal is largely restricted to its application in the form of an electroplate. The electrolyte is the strongly oxidizing chromic acid with small quantities of sulphate or fluoride as a catalyst. The current densities used in the application of chromium vary from 1 amp/sq. in. to 4 amp/sq. in., while the temperature range is 105 to 160° F. The structure of the deposit is extremely fine-grained, striated, columnar and exhibits a high degree of preferred orientation. The mechanism of the deposition is not known although it is fairly well established that it does not follow classical rules for electrolytic deposition of metals.

In the as-plated condition the hardness of the chromium deposit varies from 600 to 1000 Knoop, although most deposits are in the range from 700 to 900 Knoop. The cause of this hardness seems to be closely related to the grain size of approximately 1.0 to 1.5 x 10^6 CM rather than to impurities or stresses. Upon annealing the hardness tends to decrease at 750 to 800° F., but doesn't soften below 500 Knoop until 1050 to 1150° F.

The high hardness, inherent corrosion resistance, anti-adhesiveness and low coefficient of friction against other metals provides the basis for most applications. Several applications wherein these attributes were used to advantage were discussed by Mr. Moeller. The formal talk was followed by a very lively question and answer period.—**Reported by E. R. Babylon for Golden Gate.**

Gives Carnegie Lecture On Alloy Steel in Defense

Speaker: E. C. Smith

Republic Steel Corp.

The **Pittsburgh Chapter** was privileged to hear E. C. Smith, chief metallurgist and director of research, Republic Steel Corp., give the ninth annual Andrew Carnegie Lecture. Mr. Smith's subject was "Alloy Steels in Defense".

Mr. Smith has had a wide and varied experience in the production of alloy steels in this country, and has been called upon to act as an advisor and liaison man between the armed forces and industry in the development of alloy steels for use in ordnance materials. He did not delve into the technical aspect of the manufacture of alloy steels, but confined his remarks generally to problems which faced the armed forces and industry in World War I, World War II, and the Korean conflict, which Mr. Smith commented, we did not dignify by referring to as a full-scale war.

He stressed the necessity of closer cooperation between the armed forces and industry in the development of new materials for ordnance application, and went on to comment as to how he felt this cooperation could be achieved.—**Reported by H. W. Paxton for Pittsburgh.**

Review Methods of Machining of Steel

Leaders at a Meeting of the Worcester Chapter Included, From Left: E. A. Hoffman, Sales Engineer, LaSalle Steel Co.; George W. Lyman, Chief Engineer, Reed Rolled Thread Die Co., Technical Chairman; Paul L. Bisdorf, Sales Engineer, LaSalle Steel Co.; and Lincoln G. Shaw, Pratt & Inman, Chairman. Mr. Hoffman and Mr. Bisdorf presented a talk on the "Machining of Leaded and High Strength Steel". (Reported by C. W. Russell)

New Haven Features Salt Bath Talk

A. F. Holden, President, A. F. Holden Co., Presented a Talk Entitled "Salt Baths and Industrial Furnaces" at a Meeting Held Recently by the New Haven Chapter. Shown during the meeting are, from left: Harold O. Seeley, vice-chairman; Mr. Holden; Calvin R. Brown, vice-president of A. F. Holden Co.; and Edwin P. Holtberg, chairman. (Report by J. L. Baker)

Speaks in Dayton on Strain Gages

F. G. Tatnall, Baldwin-Lima-Hamilton Corp., Presented a Talk on "Strain Gages" at a Meeting Held Recently by the Dayton Chapter. Present were, from left: W. Bryan, vice-chairman; L. McBride, chairman; Mr. Tatnall; and R. Grayson, chairman, publicity committee. (Report by R. Grayson)

Chromium Coatings Is Subject at Rockford

Speaker: R. Seelig

Chromalloy Corp.

At the New Members Night meeting of the **Rockford Chapter,** Richard P. Seelig, executive vice-president, Chromalloy Corp., talked on "Diffused Chromium Coatings".

Chromizing is a process wherein chromium is diffused in most ferrous and some nonferrous metals, thereby increasing their resistance to oxidation, corrosion and abrasion. The process is carried out by packing parts in a powdered compound in special alloy retorts and processing at high temperatures. Gaseous chromium compounds are evolved which reach all surfaces of the parts being treated. At these surfaces the volatile chromium compounds interact with the base materials depositing metallic chromium atoms with the elements of the base alloy. This results in either a hard or ductile case, integrally bonded to the base metal, having characteristics which largely depend on the composition of the treated metal parts.

With steels having a low carbon content, the diffused metallic chromium forms an iron-chromium alloy case with chromium content decreasing from approximately 45% at the surface to zero at the root. This case is characterized by good resistance to scaling and corrosion at elevated temperatures. Since the case is produced at high temperatures and the parts are slowly cooled, the chromizing leaves the base materials in the fully annealed condition. The case is continuous and is quite ductile so that relatively severe forming operations can be performed.

Chromium has a tendency for preferential combination with carbon which causes a differential type of case to be formed. The case formed with high carbon steels is essentially chromium carbide, thereby imparting a high degree of wear or abrasion resistance. Some of the typical materials on which this carbide case can be formed are cast iron, plain carbon steels with a minimum of 0.40% carbon, and toolsteels.

The selection of materials out of which parts are to be made is determined by service function. When chromizing is considered and a case with special properties is required, the alloy should be selected on the basis of the type of case it forms on chromizing.

During his lecture, Mr. Seelig pointed out specific applications in which chromizing was successfully used.—**Reported by Joseph F. Sisti for Rockford Chapter.**

A.S.M. spends $44.50 to service each member of the society for a period of one year.

Corrosion Fundamentals Outlined at Milwaukee

Speaker: R. B. Hoxeng
U.S. Steel Corp.

R. B. Hoxeng, assistant to the director, Applied Research Laboratory, United States Steel Corp., presented a lecture before the **Milwaukee Chapter** entitled the "Fundamentals of Corrosion".

Dr. Hoxeng's talk dealt with the electrochemical principles of corrosion. He stated that the principal factors concerning corrosion are: (1) the metal or metals involved; (2) the environment; and (3) the barrier film. An excellent means of determining the rate of corrosion is to measure the electron flow, because corrosion is simply a transfer of electrons. The effect of an inhibitor is to add a resistor to the circuit. Corrosion can take place in bimetallics or unimetallics. In bimetallics, cathodic and anodic reactions are set up due to the differences in normal electrode potential, and in unimetallic, because of heat treatment, grain boundaries or concentration cells.

Other factors that affect the rate of corrosion are the amount of oxygen, the temperature, the pH, and the application of protective coatings.

The meeting closed with a question and answer period, which covered, to some extent, the methods used to evaluate high-temperature corrosion resistance.—**Reported by Donald P. Kedzie for Milwaukee.**

A.S.M. Announces New Publications Division

W. H. Eisenman, national secretary of the American Society for Metals, has announced the establishment of a new A.S.M. activity to be known as the Publication Development Division.

The Division will be under the administration of Taylor Lyman, editor of the A.S.M. *Metals Handbook*. Hans J. Heine, former technical director of American Foundrymen's Society, will be technical director. James P. Hontas, staff metallurgist, and Carl H. Gerlach, staff engineer, will be assistants. Headquarters for the new operation have been established at 20701 Kinsman Rd., Shaker Heights, Ohio.

Principal purpose of the new Division is to work with industry and Government agencies in the development of authoritative books and other reference materials concerning metalworking processes and metals engineering design. This work will complement and extend the Society's other publishing activities. The first major project will be the preparation of a casting design manual, under contract to the Air Materiel Command, U. S. Air Force.

Drop Forgings Discussed at Tulsa

W. Naujoks, Manager of Engineering, Kropp Forge Co., Talked on "Drop Forgings for Industrial Applications" at a Meeting Held by the Tulsa Chapter. He covered methods and procedures used in drop forging of steels, with special emphasis on problems in correct die design and control of the metal during forging. Shown are, from left: W. L. Smith, program chairman; G. R. Clay, chairman; Mr. Naujoks; and A. Hardy, reception

Clark Is Guest of Jackson Chapter

Jackson Chapter Members Heard National President Donald S. Clark Speak on the "Dynamic Properties of Metals" at the Recently Held National Officers Night Meeting. Shown at the speaker's table are, from left: E. T. Schallhammer, secretary-treasurer; C. R. St. John, vice-chairman; and Dr. Clark. (Reported by V. G. Goodell for the Jackson Chapter)

Student Receives Scholarship

Robert Janninck, a Senior Student in Metallurgy at University of Illinois, Was Recently Presented an A.S.M. Scholarship by A. L. LaMasters, Chairman of the Peoria Chapter. Mr. Janninck, a graduate of Fenwick High School in Chicago, plans to continue in graduate work, majoring in research. Shown, from left: W. Becker; Mr. Janninck; Mr. LaMasters; and T. A. Read, head of the department of mining and metallurgy

Warren Chapter Holds Symposium on Titanium

At Warren Chapter's Titanium Symposium Are, Standing, From Left: C. H. Weimer, Secretary-Treasurer; E. Heffner, Chairman; and H. A. Blair, Vice-Chairman. Seated: B. H. McKibben, Manager, Quality Control, and D. Evers, Associate Director of Research, Mallory-Sharon Titanium Corp.; I. A. Oehler, moderator, vice-president, American Welding & Manufacturing Co.; and F. H. Vandenburgh, vice-president and general manager, and R. M. Scriver, superintendent of melting, Mallory-Sharon Titanium Corp.

Speakers: F. Vandenburgh, D. Evers, B. H. McKibben, R. M. Scriver

Mallory-Sharon Titanium Corp.

At a recent meeting of the **Warren Chapter,** a panel meeting and discussion on "Titanium" was held. Moderator for the panel was Irving A. Oehler, vice-president, American Welding and Manufacturing Co. Panel members were Frank Vandenburgh, vice-president and general manager, Dillon Evers, associate director of research, B. H. McKibben, manager of quality control, and R. M. Scriver, superintendent of melting, Mallory-Sharon Titanium Corp.

Mr. Vandenburgh opened the meeting with a brief history on titanium. Titanium has been known since 1871 but it has only been in the last few years that we have learned how to handle it. Its greatest importance is due to its lightness and corrosion resistance. At present, approximately 97% of all the titanium produced goes into Air Force applications.

Mr. Evers gave an outline of how the function of the laboratory is carried out. It was explained that there is a subdivision into process group, production group and research group. Under these groupings all application and alloy development is carried out. At present, alloys of titanium and a single element, and titanium in ternary compounds, are being manufactured. Very little information is obtainable on four and five element compounds of titanium. Also being investigated are mechanical and physical properties at elevated temperatures for aircraft applications.

Mr. Scriver explained the progress made in melting since the first induction furnace five years ago. The next furnace used after the induction-type was the water-cooled copper crucible with graphite electrodes. This resulted in ingots with a large amount of porosity.

After about two years a switch was made to the present furnace, a consumable electrode type with an argon atmosphere. At first this furnace was dangerous because of the numerous explosions. This has been taken care of in the new furnaces now in operation. These are in a barricade of steel and are operated remotely. The atmosphere used is still argon. All titanium currently produced at Mallory-Sharon is melted twice in a consumable electrode furnace which yields the best product from a quality standpoint.

Mr. McKibben stressed the rigid quality control imposed on the manufacture of titanium. Twelve percent of the total employees work in the quality control group. It is the responsibility of this group to check the product from the sponge to the finished product. Chemistry, mechanical properties and soundness are checked in production lots and also in the finished product. The testing program on titanium is more strict than on steel.

During the discussion period which followed it was brought out that titanium has an advantage of strength-to-weight ratio over steel. This holds true up to approximately 800° F., at which time the high strength steel alloys gain an advantage.

An interesting discussion on titanium sponge and how it is produced from the more important ore rutile (TiO_2) was held. This is accomplished by mixing the rutile ore with coke and reacting it with chlorine gas to form titanium tetrachloride. This in turn is then reacted with magnesium metal to form magnesium chloride and titanium sponge. The market price of the sponge is approximately $3 a lb.—**Reported by T. P. LaVelle for Warren.**

Talks on Reactor Materials And Technology at Phoenix

Speaker: W. D. Manly

Oak Ridge National Laboratory

"Do It Yourself" enthusiasts heard a talk on "Reactor Materials and Reactor Technology" by W. D. Manly, at a recent meeting in **Phoenix.**

The speaker, who is associate director of the metallurgical division, Oak Ridge National Laboratory, "built" the family car of the future. The purposes of the six main components of a reactor were explained and a reactor was assembled.

The main components mentioned were fuel, coolant, shield, moderator, control and structure, and each was shown to be a compromise of economic, metallurgical and scientific requirements.

The need for nuclear energy in future years was pointed out, as the world is rapidly using up its available coal and oil.—**Reported by W. J. Feuerstein for Phoenix.**

Metallurgical News and Developments

Devoted to News in the Metals Field of Special Interest to Students and Others

A Department of *Metals Review*, published by the
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Nuclear Research Center—Plans for construction of a nuclear research center in Sterling Forest, N.Y. (located in Orange County, approximately 40 miles from New York City), have been announced by Union Carbide and Carbon Corp. Facilities will include a five-megawatt pool-type reactor, a radioactive materials laboratory, an ores and engineering laboratory, and a building for allied research operations and administrative functions. Research programs will be geared to the study of the effects of radiation on products and processes involving plastics, gases, metals, carbons and chemicals.

To Build—Lukens Steel Co. will begin construction of a $1-million physical testing laboratory soon. It will be equipped with the latest devices for testing the hardness, toughness, strength, elasticity and internal quality of Lukens alloys and alloy-clad steel plates.

Super-Strong Magnet—Working with invisible iron "dust", G. E. researchers have created a revolutionary and potentially super-strong magnet. The unique properties of this magnet are achieved by precisely controlling the size and shape of individual iron particles so small that there are more than a billion billion in a pound. Theoretically, the ultra-fine particle iron magnet can be made ten times stronger than the best available magnets.

Pilot Plant—Mallory-Sharon Titanium Corp. has announced plans for construction of a large-scale pilot plant for refining titanium scrap, using a new electrolytic process that yields extremely pure metallic titanium. The plant's refining capacity will be large enough to permit complete evaluation of the new process.

Atomic Co-Op—Norton Co. has been authorized by AEC to exchange information and services under the U.S. bi-lateral agreement with Canada for cooperation concerning civil uses of atomic energy. The company is authorized to perform services for the Government of Canada, including the communication of secret and confidential restricted data, and to receive and possess such services from the Canadian Government.

Combine Efforts—Ajax Engineering Corp. and Ajax Electric Furnace Corp., have announced that they are combining their engineering, manufacturing and sales efforts to serve the industry in the most efficient manner in the field of electric line frequency induction melting of ferrous and nonferrous metals.

Thin-Walled Tubing—A process for forming and welding of very light-gage tubes in continuous lengths from high-tensile cold rolled alloy strip has been developed by Universal Tube Corp. This process provides continuous lengths to 200 ft., better mechanical properties for corresponding metal thicknesses and diameters, and lower cost than seamless drawn tubes in equivalent sizes.

Join Forces—Bendix Aviation Corp. has entered a contract to aquire the business and assets of the Sheffield Corp., a privately owned company which is one of the major manufacturers of precision gaging and measurement instruments, and industrial inspection and quality control systems.

Deep Drawing Ti—Successful deep drawing of titanium alloys has been announced by Worcester Pressed Steel Co. Titanium alloys can now be fabricated by mass-production stamping methods. Previously, only pure titanium had been successfully deep drawn. Titanium alloys, which have more useful properties than pure titanium, were believed to be unsuitable for stamping because of their "difficult" working properties.

Foundry Shakeout — Hewitt-Robins, Inc., has developed a nonferrous foundry shakeout of compact design which removes sand from castings faster and more completely than previous shakeouts and is more economical to operate. The machine will handle brass, bronze or aluminum molds up to 30 in. sq. and weights up to 500 lb.

Continuous Light—An atom-powered railroad signal light which will burn continuously for 12 years has been developed by researchers at the Burnham Laboratory for the Denver & Rio Grande Western Railroad as a byproduct of work on an atom-powered locomotive. Research engineer Ray McBrian, past chairman of the Rocky Mountain Chapter, said that the light was first developed by the Navy for use on shipboard. The railroad version is composed of four 3-in. disks coated with phosphor. The disks are sealed in the signal casing, which is filled with Krypton 85, a radioactive gas.

Australian Plans—Reynolds Metals Co. has announced plans to establish aluminum fabricating facilities in Australia, including a foil mill of sufficient capacity to meet Australian market demands for aluminum foil. The plant can be expanded later for fabrication of other aluminum products.

New Division—Formation of a Hydraulic Controls Division has been announced by the North American Manufacturing Co. The new division manufactures and markets a high-gain hydraulic amplifier for use in pressure regulation, flow control and other situations requiring amplification of signal forces of a few grams to hydraulic operating forces ranging to 100,000 ft.lb. per min. or more.

Stainless Building — Crucible Steel Co. of America played host to West Coast businessmen and industrialists at the official opening of its new specialty steel warehouse and sales office, the first all stainless steel office building west of the Mississippi, during the week of the Western Metal Congress and Exposition in Los Angeles, Mar. 25-29.

Strip Mill—The latest model American cold strip rolling mill is now in operation at the Duisburg-Hamborn works of August Thyssen-Huette AG, German steel producer. The mill, one of the few continuous cold strip rolling mills in Europe, was built by the Continental Foundry & Machine Division, Blaw-Knox Co.

Brazing Alloy—A self-fluxing brazing alloy, Handy Alumibraze, for joining many types of aluminum alloys is being produced by Handy & Harman. Supplied as a dry powder and applied as an aqueous slurry, this alloy makes possible certain joining techniques which were not heretofore considered practical.

Outlines Prospects of Metal Industries

G. F. Sullivan, Editor, Iron Age, *Spoke on "What's Ahead for Metalworking" at a Recent Meeting of Calumet Chapter. Pictured are, from left: J. R. Woodfill, technical chairman; Mr. Sullivan; and P. H. Booth, chairman*

Speaker: G. F. Sullivan
Iron Age

"What's Ahead for the Metalworking Industry?" was the subject of a talk given by George F. Sullivan, editor of *Iron Age,* at a meeting held by the **Calumet Chapter.**

Mr. Sullivan stated that 1957 would be a good year for the metalworking industries. Production may not be much above the 1956 level, but the dollar figures should be higher due to inflationary trends. Inflation may develop from higher costs of raw materials, fuel, labor and finished products. For instance, steel prices may be increased by $5 per ton. Defense spending of $38 billion will tend to add to the inflationary spiral.

Mr. Sullivan analyzed the 1957 prospects of the automotive, steel, machine tools, construction, new plant and equipment, aircraft, atomic energy, coal, aluminum and copper industries.

The automotive group expects a better year in 1957 than 1956. Trends are toward more real design changes and less face lifting on new models. Higher costs and lesser availability of credit may deter sales. Counteracting these deterrents are higher personal incomes and faster payoffs of installment credits.

The steel industry expects to produce 116 to 120 million tons in 1957. Prospects for a good year are based on automotive needs, railroad expenditures, farm spending, steel expansion and plate and structural requirements. Machine tools are aiming for a second consecutive billion-dollar year; 1956 set a peace-time record. New plants and equipment will involve $35 to $40 billion in 1957 as compared to $35 billion last year. The aircraft industry rates as the number one employer in the nation. Its backlog amounts to $17.2 billion, of which 80% is for military orders.

Atomic energy continues to grow. In 1956, contracts for 59 reactors were being processed. In addition, 134 more industrial firms began using radioactive isotopes, and greater interest is expected in 1957.

The coal industry expects to mine 461 million tons in 1957, compared to 448 million in 1956. Heavy demands for machinery are expected. The aluminum industry has finally caught up with the demand for this metal. New uses are expected to increase consumption by 10% in 1957; 1.5 million tons were produced last year. Copper should have some stability in production and price since the negotiation of three-year labor contracts.

Looking beyond 1957, Mr. Sullivan felt that a $500 billion gross national product (GNP) was not unlikely before 1965. He mentioned the following stabilizers which should prevent a depression: offsetting tax structure; farm price supports; unemployment compensation; pension programs; deposit insurance; self-amortizing debts; liquidity of assets; and defense spending.

The speaker commented upon the marvels of production which have developed in the past ten years, covering the growth in atomic energy, aircraft, aerosols, aluminum, automobiles and automation.

To keep production alive, Mr. Sullivan stated that distribution must keep pace. It must be handled by effective selling methods, not only of company products, but of companies themselves. To attain a $500 million GNP, sales to consumers must be increased by 35%. Unless war conditions intervene, the next ten years should bring a fantastic improvement in our living standards. **—Reported by J. W. Luoma for Calumet Chapter.**

OBITUARY

NORMAN C. MACPHEE, chief of the Physical Metallurgy Division of the Mines Branch, Department of Mines & Technical Surveys, Ottawa, Canada, passed away in February at the age of 60 after a long illness.

Mr. MacPhee was a graduate of Queen's University, and worked for a number of foundries in the U.S.A. and Canada prior to joining the government service in 1941. He became chief of the Physical Metallurgy Division in 1951.

He was very active in technical societies, having served as chairman of the Ottawa Valley Chapter A.S.M., and director of the Eastern Canada Chapter A.F.S. He also was a member of a number of committees of the Canadian Institute of Mining and Metallurgy. Mr. MacPhee was a Navy veteran of the First World War.

Named Industrial Award Recipient by New York

Marcel A. Cordovi, head of the materials and testing department, Atomic Energy Division, Babcock & Wilcox Co., was named recipient of the second annual Industrial Achievement Award of New York Chapter.

Commenting upon the award, Charles M. Parker, chairman of the Award Committee, lauded Mr. Cordovi for his "brilliant achievements in the field of metallurgy. Many have had longer tenures in the profession than our recipient, but it is a rarity to find so young an individual who has attained so much in a scientific field".

M. A. Cordovi

Mr. Cordovi was born in Sofia, Bulgaria, on Nov. 17, 1915, and received his A.B. degree in general sciences and arts from the American College at Sofia in 1935. He holds B.M.E., M.M.E. and M.E. degrees from the Polytechnic Institute of Brooklyn, and has studied metallurgical and mechanical engineering at the University of Michigan and the University of Pittsburgh. He is presently adjunct professor of metallurgical engineering at the Institute.

Joining the tubular products division at Babcock & Wilcox in 1943 as research metallurgist, he was promoted to supervisor of research in 1946, and to staff metallurgical engineer, boiler division, in 1949. He was transferred to the Atomic Energy Division in 1953, where his present duties include planning and direction of metallurgical and fabrication feasibility investigations undertaken by the A.E.D., chemical technology projects, and the selection and specification of materials for equipment being designed for all atomic energy projects.

The author of more than 20 technical papers, Mr. Cordovi has been metallurgical consultant since 1951 to Brookhaven National Laboratory, where he was one of the pioneers of the liquid metal fuel reactor concept. He is also official United States representative to the International Institute of Welding.

Discusses Stainless Steel At Jacksonville Meeting

Speaker: J. P. Kelleher
Carpenter Steel Co.

James P. Kelleher, assistant manager of specialty products for the Alloy Tube Division, Carpenter Steel Co., spoke on the "Corrosion Resistance of Stainless Steels" at a meeting of the **Jacksonville Chapter.**

Mr. Kelleher discussed the corrosion-resisting qualities and limitations of stainless steels, and explained how they can be used to minimize the rising cost of maintenance and down-time in industry. He described the trend toward greater use of corrosion-resistant materials, and talked briefly of the need to select and apply them properly.

In his present position with Carpenter, Mr. Kelleher provides engineering assistance in the proper selection and application of stainless steels and other corrosion-resistant materials of construction. He has had extensive experience in research and development, and in process engineering for the petroleum and petrochemical industries.

The meeting was held at the St. Regis Paper Co., and began with a plant tour which took in everything from the wood yard to the finished craft paper.

Use of Digital Computers In Research Explained

Speaker: D. E. Hart
General Motors Corp.

D. E. Hart, assistant head of the special problems department, Research Staff of General Motors Corp., talked to members of the **Purdue Chapter** on the "Use of Digital Computers in Research and Development Work". By way of explanation he took a quadratic equation problem and went through the seven steps required in setting up and solving the problem using a computer. The steps were: (1) problem formulation; (2) mathematical analysis; (3) programming; (4) coding; (5) checkout on the computer; (6) production computation; and (7) evaluation of results.

He further explained that computers can effectively solve two classes of problems. Those which could be done by hand and those which cannot be done by hand because the calculations must be carried out sequentially. The computer is quite valuable to development because of the savings in time and costs possible. These advantages were shown by his explanation of the part computers played in the development of the gas turbine engine at General Motors.—**Reported by H. C. Boose for Purdue.**

Gives Hints for Engineering Careers

"Engineers and Jobs—Adapting One to the Other" Was the Topic of a Talk Given by Harold L. Maxwell, Special Assistant to Management in the Engineering Services Division, E. I. du Pont de Nemours & Co., at a Meeting of the Savannah River Chapter. Shown at the speaker's table are, from left: J. S. Burpulis, P. H. Permar, Dr. Maxwell, S. P. Rideout and W. L. Worth, (Photograph by A. B. Thomas for Savannah River)

Speaker: H. L. Maxwell
E. I. du Pont de Nemours & Co.

"Engineers and Jobs — Adapting One to the Other" was the topic discussed by Harold L. Maxwell, E. I. du Pont de Nemours & Co.'s engineering department, before a recent meeting held by the **Savannah River Chapter.**

Discussing the factors which go into a satisfying industrial career, Dr. Maxwell stressed that personal attributes are often as important as technical ability. High on the list of traits that make successful engineers are perseverance in working toward a desired result and the ability to cooperate with other people. Promotions come most readily to men who can conduct their dealings with others with courtesy and tact instead of high pressure; to mature and stable men who can realistically accept both success and disappointment in their work; and to men who can develop the talents of others working for them. There are vast differences between working with things and with people, Dr. Maxwell asserted. Respect people and use things, not vice versa.

Cincinnati Past-Chairmen Meet

Past Chairmen Present at the Past Chairmen and National Officers Night Meeting of the Cincinnati Chapter Included, From Left, Seated: George B. Reisenberg, William M. Ball, Kurt Siems, M. H. Brumble and George Gerdes; and Standing, From Left: William Maddox, Walter Archea, Fred Westermann, Voight Procter, Reid Kenyon, Walter A. Spear, Walter Klayer, A. L. Hartley, and William Whalen. Harley A. Wilhelm, national trustee A.S.M., presented a discussion on the "Metallurgy of Uranium"

Talks on Metallurgy of Atomic Energy

H. A. Wilhelm, A.S.M. National Trustee, Presented a Talk Before Members of the Louisville Chapter Entitled "Metallurgy of Atomic Energy". Shown are, from left: R. G. Thompson; Dr. Wilhelm; and J. A. Witherington

Speaker: H. A. Wilhelm
National Trustee

At a recent meeting held by the **Louisville Chapter,** a talk entitled "Metallurgy of Atomic Energy" was presented by H. A. Wilhelm, associate director of the Ames Laboratory of the Atomic Energy Commission at Iowa State College, and national trustee A.S.M.

Dr. Wilhelm discussed early development work leading to the present process for large-scale production of uranium and related metals. After a brief summary of the background information concerning the development work in uranium, Dr. Wilhelm described the several elements which can lead to a fissionable material and through a series of slides illustrated how fission is accomplished in the produced elements.

He also talked about several materials which are used for control rods in atomic reactors and showed why some are much better than others.

In closing, Dr. Wilhelm emphasized that the success of the present nuclear reactor program is largely dependent on new metals and alloys developed by the metallurgist.—**Reported by E. D. Gardner for Louisville Chapter.**

A.S.M. Plans New Chapter

A new chapter of the American Society for Metals, to be known as the Columbia Chapter, is being considered for the area around Columbia, S. C., and will include members from Columbia, Hopkins, West Columbia and the surrounding areas.

Temporary officers include: George E. Daniels, Earl DeLay and Co., chairman; Royce G. Waites, Commercial Roofing & Sheet Metal Co., vice-chairman; F. Cox, Columbia Products Co., secretary; and D. W. Weber, Southern Plastics Co., treasurer.

Cites Principles of the Art of Spark Testing

Speaker: E. E. Bishop
Wyckoff Steel Co.

An interesting presentation on the "Art of Spark Testing" was delivered to the **Rocky Mountain-Denver Chapter** by Edsel E. Bishop at a recent meeting. Mr. Bishop, manager of products development at the Wyckoff Steel Co., is one of the founders of modern spark testing practice, which incorporates scientific principles into an historic art.

The use of spark testing for the identification of alloys dates back to the time of the Napoleonic wars, when it was reportedly employed at cannon factories. At the present time the state of this flexible art has advanced to the stage where, in addition to the qualitative and quantitative detection of elements, it can describe the deoxidation practice employed on a material as well as the heat treated condition. A skilled spark tester can identify up to 600 samples per hr. and detect the presence of some elements in concentrations as small as 0.02%.

The basis of the technique is the characteristic types of sparks produced by different steels when touched to a grinding wheel. The metal is physically torn off under hot conditions and while still partly in the molten state a complex chemical reaction occurs between the carbon constituent and the surrounding oxygen, producing a series of minute explosions. The presence of other alloying elements in the steel characteristically modifies the appearance of these carbon explosions (or sparks) depending upon the relative affinities of these elements to oxygen. The resulting types of sparks can be identified with precision by a well-trained specialist.

Mr. Bishop illustrated his talk with a colored motion picture and a unique series of three-dimensional slides. Besides demonstrating the main classifications of spark types, he showed the infinite variations which the expert is capable of interpreting. The speaker emphasized the importance of understanding the principles of the technique rather than memorization of patterns. He also stressed the economic value of this rapid means of identification for the steel producer and fabricator as a supplement to regular chemical analysis.—**Reported by F. C. Perkins for Rocky Mountain-Denver.**

Syracuse Hears One of Four Horsemen

Harry A. Stuhldreher, Assistant to Vice-President, U. S. Steel Corp., Gave a Talk Entitled "It Takes People" at a Meeting Held by Syracuse Chapter. Mr. Stuhldreher, a member of Notre Dame's Four Horsemen under Knute Rockne, presented an informal talk on football and coaching. Shown with Mr. Stuhldreher, center, are J. O. Ochsner, vice-chairman (left) and J. A. Miskelly, chairman (right). (Reported by G. Trojanowski)

Cites Factors That Affect Durability Of Carburized Cases

Speaker: R. F. Thomson

General Motors Corp.

At a meeting of the **Cincinnati Chapter**, R. F. Thomson, head, Metallurgical Engineering Research Staff, General Motors Corp., presented a comprehensive report on the fatigue durability of carburized parts in a talk entitled "Factors Affecting Durability of Carburized Cases".

Dr. Thomson pointed out that the research program did not solve the problem as originally proposed but succeeded in raising new questions. He indicated that carburizing specifications required answers to basic considerations of the grade of steel, case depth, heat treatment, finish, microstructure and service requirements.

The speaker mentioned that earlier work proved the conception that the compressive stresses in the case improved fatigue durability and that high case hardness was associated with high durability.

The test program in studying the factors affecting fatigue durability incorporated the following variables: (a) effect of surface oxidation; (b) effect of processing variables on residual stresses; and (c) effect of residual stress on fatigue durability.

The fatigue tests employed in evaluating durability were made in single direction bending on rounds, employing high enough load levels to provide fatigue results in the finite life region. The residual stress measurements were calculated from changes in deflection resulting in samples from which thin layers had been removed by very careful grinding. Reproducibility of residual stress from sample to sample was of the order of magnitude of 10,000 psi. maximum.

Surface oxidation had a marked effect, under some test conditions, on fatigue life of carburized parts as compared with samples having a nonoxidized surface. However, there was no difference in the residual stresses between samples carburized in conventional atmospheres and those carburized in cracked ammonia-methane atmosphere.

The effect of processing variables on residual stresses could be summarized as follows:

(1) Residual stress is independent of carrier gas.
(2) Residual stress is highest with low core hardness.
(3) Residual stress in the case increases with increasing case depth.
(4) Maximum stress is independent of case depth.
(5) Residual stresses are reduced by tempering.
(6) Residual stresses are independent of reduction in residual austenite as obtained by refrigeration.
(7) Residual stresses are not cyclic stress dependent in unidirectional bending tests.

Having evaluated the factors affecting residual stresses, the next problem was that of evaluating the variables with respect to fatigue durability. These variables included material composition, case depth, tempering, refrigeration and electropolishing.

It was found that material of medium hardenability gave better fatigue life than high hardenability where the microcracks are found in the martensite needles. Case depth had no effect on fatigue durability as long as failure starts at the surface. Thus, in terms of section size for a given case depth, if the ratio of case to core is too small, poor fatigue life can result due to excessive stresses in subsurface layers.

Depending on the stress level, tempering may reduce fatigue durability, while lowering of residual austenite by refrigeration lowers the fatigue durability slightly.

The greatest effect on fatigue durability results upon removal of 0.002 in. from the surface. This type of removal, which is used because it does not introduce additional grinding stresses, results in significant increases in fatigue durability. Further investigation of residual stresses in the 0.002-in. surface revealed large differences in the compressive residual stresses showing variation of surface residual stresses of 40,000 psi. compression to 2000 to 5000 psi. compression just slightly below the surface.

In summation Dr. Thomson pointed out that residual stress pattern changes below 0.002 in. from the surface can be predicted generally from existing knowledge, the range of residual compressive stresses in the case is lower than generally suspected, that while residual stresses can be changed, there does not seem to be a corresponding effect on fatigue durability and that the residual stress pattern in the 0.002-in. case surface is not clearly established and should serve as basis for further investigation.—**Reported by John H. Timmers for Cincinnati.**

Columbia Basin Hears President Clark

The Columbia Basin Chapter Was Honored by the Recent Visit of Donald S. Clark, National President A.S.M. Dr. Clark spoke on the "Dynamic Properties of Metals". Shown in a discussion with members of the Chapter are, from left: Roy W. Wirta, Dr. Clark and W. P. Wallace

Aging and Embrittlement of Mild Steel Topic at Ontario

Speaker: Samuel Epstein

Bethlehem Steel Co.

Members of the **Ontario Chapter** heard Samuel Epstein, technical adviser, research department, Bethlehem Steel Co., speak on "Aging and Embrittlement of Mild Steel" at a recent meeting.

Mr. Epstein presented an excellent talk, well illustrated by a great number of most interesting slides. He divided the talk into two principal groups, one pertaining to sheet, the other to plate. He then explained the old and new theories pertaining to aging and embrittlement and pointed out the mechanism involved in the processes, as well as the relative influence of carbon, nitrogen and oxygen during strain aging and quench aging.

Concerning plate, Mr. Epstein discussed V-notch Charpy results obtained at various temperatures on plate from salvaged ships.—**Reported by V. G. Behal for Ontario.**

Cites Property-Design Relationships

R. V. Meghreblian, Oak Ridge National Laboratory (Left), Is Shown With A. Taboada, Technical Chairman, at a Meeting in Oak Ridge. He spoke on the "Relation of Metallurgical Properties to High-Temperature Design"

Speaker: R. V. Meghreblian
Oak Ridge National Laboratory

Members of the **Oak Ridge Chapter** heard a discussion of metallurgy from a design engineer's viewpoint at a meeting when R. V. Meghreblian of the Oak Ridge National Laboratory spoke on the "Relation of Metallurgical Properties to High-Temperature Design".

The speaker described his talk as an attempt to illustrate some of the problems encountered in designing high-temperature, high-performance systems. He first contrasted the philosophy of design required for high-temperature design with that required for moderate-temperature design. Four essential differences were listed. They were:

1. The operational lifetimes of high - temperature structures are markedly less than those of low-temperature structures.

2. High-temperature design analysis is based primarily upon the concept of strain whereas low-temperature design is more commonly based on the concept of stress.

3. More precise engineering and metallurgical knowledge is required in designing high-temperature devices since performance specifications are frequently pushed to the limit.

4. Materials data at high-temperature are still scarce and test facilities for attaining these data are expensive and time consuming to operate.

Dr. Meghreblian pointed out that a unique facet of high-temperature design is that the design requirements are frequently very close to the material property limits. Thus a great deal of high-temperature data is required, and each piece in the design must be closely followed through the fabrication and inspection processes.

Since designs are close to property limits, little margin for property variations due to prior cold work, grain growth, internal flows, etc., can be allowed.

Still another complication is the difficulty encountered in designing and operating tests to simulate operating conditions.

The four principal steps in the design of a structural component were given as: (1) Specification of operating conditions and loads; (2) determination of the physical and metallurgical properties of the materials of construction; (3) the application of these data to engineering design; and (4) the fabrication and test of the structure.

The lifetimes of high-temperature devices may be measured in minutes, hours or days. Of the many physical phenomena affecting the life of the device, strain cycling effects from thermal or mechanical causes are among the most important. The determination of the plastic strain due to every possible cause is a most important step in design.

Mr. Meghreblian mentioned some of the problems encountered in high-temperature design including creep rupture, creep-buckling (columns, plates and shells), strain-cycling and relaxation, discontinuity stresses, high-temperature fatigue due to high-frequency strain fluctuations, and thermal shock and impact.

Some of the information on high-temperature materials needed by design engineers and not now available includes creep data at constant stress and under multi-axial stress distribution, creep properties in compression, relaxation properties, strain-cycling data, and fundamental information on fatigue, cumulative damage and stress corrosion.—**Reported by A. Goldman for Oak Ridge.**

Indiana Symposium

The Ninth Annual Symposium of the Indiana Chapters A.S.M. will be held at Purdue University on Apr. 27. Theme of the meeting will be "Materials and Temperature" and speakers include Maurice Day, Crucible Steel Co. of America, F. C. Hopton-Jones, Convair, D. L. Frey, Ford Motor Co., and D. W. Levinson, Armour Research Foundation.

Over 1000 Guests Enjoy Jersey Smoker

Over 1000 Persons Attended the 20th Annual Smoker Held by the New Jersey Chapter at the Essex House in Newark. Shown are the men who were instrumental in setting up the social evening so much enjoyed by the members and guests, from left: A. A. Scafati, entertainment chairman; D. A. Butler, public relations chairman; and J. J. Hauptley, chapter chairman

CHAPTER MEETING CALENDAR

Akron	**May 18**	Sanginiti's	**Social**	Dinner-Dance
Albuquerque	**May 22**	La Placita	**J. H. Frye, Jr.**	Economic Atomic Power
Atlanta	**May 1**		**D. S. Clark**	National Officers Night
Baltimore	**May 20**	Engineers Club		Project Vanguard
British Columbia	**May 4**	Peace Portals	**Social**	Golf Outing
Buffalo	**May 9**	South Shore Country Club	**Social**	Golf Party
Calumet	**May 14**	Phil Smidt's	**F. G. Tatnall**	Fatigue and Life Testing
Canton-Massillon	**May 14**	Mergus Restaurant	**E. M. Mahla**	Modern Metals
Cedar Rapids	**May 14**	Roosevelt Hotel	**D. A. Campbell**	Gas Burners and Their Applications
Chattanooga	**May 21**	Maypole Restaurant	**F. S. Badger**	High-Temperature Alloys
Chicago	**May 10**	Old Spinning Wheel	**Social**	Ladies Night
Chicago-Western	**May 10**	Old Spinning Wheel	**Social**	Ladies Night
Cincinnati	**May 9**		**Business**	Annual Meeting
Cleveland	**May 6**	Hotel Hollenden	**M. W. Lightner**	Future Developments in Iron and Steel
Columbus	**May 1**	Broad St. Church	**D. E. Walcutt**	Modern Trends in Forging
Dayton	**May 23**		**Social**	Golf and Stag Party
Detroit	**May 13**	Engineering Society	**H. B. Knowlton**	Gear Steel Metallurgy
Eastern New York	**May 14**	Edison Club	**C. Smith**	Medieval Metallurgy
Golden Gate	**May 13**	Spenger's Grotto	**A. M. Aksoy**	Vacuum Metallurgy
Hartford	**May 14**		**D. S. Clark**	Interpretation of Dynamics
Indianapolis	**May 20**	Village Inn	**R. Easton**	Continuous Casting of Steel
Los Alamos	**May 21**		**J. H. Frye, Jr.**	Materials Problems in Power Reactors
Los Angeles	**May 23**	Rodger Young Aud.	**A. M. Aksoy**	Vacuum Treating of Liquid Metals
Mahoning Valley	**May 14**	Youngstown	**Plant Visit**	Metal Carbides Corp.
Milwaukee	**May 10**	Tripoli Country Club	**Social**	Spring Dinner-Dance
Montreal	**May 6**	Queen's Hotel	**Business-Social**	Annual Meeting and Ladies Night
Muncie	**May 14**		**Social**	Ladies Night
New Jersey	**May 20**	Essex House		Guided Missile NIKE
New York	**May 13**	Hotel Delmonico	**G. Kappelt**	Selection and Methods of Forming Metals
N. E. Pa.	**May 9**	Irem Temple Club	**A. O. Schaefer**	Large Steel Forgings
N. W. Pa.	**May 16**	Erie	**F. McGuire, Jr.**	Synthetic Jewels
North Texas	**May 24**	Pioneer Palace	**Social**	Spring Party
Notre Dame	**May 8**		**R. W. Perry**	It's Cheaper to Move Than Remove Metal
Oak Ridge	**May 15**	K. of C. Hall	**C. K. Ewing**	Artistry and the Engineer
Ontario	**May 3**	Toronto	**Panel**	Stump the Experts
Oregon	**May 10**		**Social**	Ladies Night
Ottawa Valley	**May 7**	P.M.R.L.	**D. Fagg**	Uses of Zinc
Peoria	**May 13**	American Legion	**R. O. Offill**	New Age of Metallurgy
Philadelphia	**May 9**	Engineers Club	**Norman Brown**	Plastic Strength of Metals (Joint Meeting With Juniors)
Phoenix	**May 20**		**E. Gostin**	Electroless Nickel Plating
Pittsburgh	**May 9**	Gateway Plaza	**M. J. Day**	
Purdue	**May 21**	Memorial Union	**A. deS. Brasunas**	Educational Future of A.S.M.
Rhode Island	**May 4**	Wannamoisett Country Club	**Social**	Dinner-Dance
Rochester	**May 13**	Elks Club	**Social-Business**	Annual Meeting
Rockford	**May 22**	Faust Hotel	**C. R. Sutton**	Metals of the Future
Rocky Mt.	**May 17**	Oxford Hotel	**H. K. Ihrig**	Romance of Metals
Rome	**May 6**	Elk's Club	**C. H. Lorig**	Fruits of Metallurgical Research
St. Louis	**May 17**	Hotel Congress	**H. L. Hovis**	Heat Treatment and Metal Processing in the Watch Industry
Savannah River	**May 9**	Tinnerman's	**W. Manly**	Atomic Powered Automobile
Springfield	**May 20**	Blake's Restaurant	**E. Gammeter**	Stainless Steels
Texas	**May 7**	Ben Milam Hotel		Vacuum Metallurgy
Toledo	**May 9**	Maumee River Club	**W. H. Eisenman**	Past and Future of A.S.M.
Tri-City	**May 8**	Rock Island Cafe	**G. A. Roberts**	Toolsteels
Tulsa	**May 7**	Alvin Hotel	**J. L. Waisman**	Corrosion Problems in Aircraft
Utah	**May 15**			Honor Night
Warren	**May 9**			Seamless Steel Tubing
Washington	**May 13**	Ft. Myer	**D. S. Clark**	Yield Phenomena in Low Carbon Steels
West Michigan	**May 20**	Morton House	**H. A. Wilhelm**	National Officers Night
Western Ontario	**May 17**	Windsor		Use of Plastics in the Metals Industry
Wichita	**May 21**	K. of C. Hall		Past Chairman's Night
Wilmington	**May 8**	Du Pont Club	**J. C. Hamaker**	Ultra High Strength Steels
Worcester	**May 8**	Stockholm	**Social**	Ladies Night

May 5-8—Jacksonville—Southern Metals Conference

May 10—Hotel Somerset, Boston—New England Regional Conference

Describes Vacuum Melted Alloys

Shown at a Meeting Held by New Jersey Chapter Are, From Left: Frank M. Richmond, Guest Speaker, Manager of Materials Research, Universal-Cyclops Steel Corp.; J. J. Hauptley, Chapter Chairman; C. C. English, Manager, High-Temperature Metal Sales, Universal-Cyclops Steel Corp.; and E. N. Ryan, District Sales Manager, Universal-Cyclops Steel Corp.

Speaker: F. M. Richmond

Universal-Cyclops Steel Corp.

New Jersey Chapter members heard Frank M. Richmond, manager of materials research, Universal-Cyclops Steel Corp., speak on "Some Vacuum Melted Alloys", at a recent meeting.

As an introduction, Mr. Richmond mentioned the cobalt-base alloy S-816 which was used for bucket material in the J-47 engine. These buckets operated at a stress of 10,000 to 18,000 psi. and at a temperature up to 1500° F. Today's engines require higher stress levels coupled with higher temperatures, problems which presented the metallurgist with the challenge of developing better alloys.

Various vacuum melting techniques have made it possible to present the industry with better alloys. It has long been known that the reactive elements, aluminum and titanium, increased the properties of these materials and one advantage of the vacuum furnace is that greater percentages of these elements can be added and closer control can be exercised over them.

In order to illustrate the fact that both strength and ductility are enhanced in vacuum melted alloys, Mr. Richmond used the example of Waspalloy. The original airmelt specification required a minimum rupture life of 23 hr. when tested at 1500° F., with a stress of 32,500 psi. There was no minimum elongation requirement on this specification. Today's vacuum melted specification requires a minimum rupture life of 75 hr. when tested at 1500° F., with 40,000 psi. There is also a minimum elongation requirement of 10% on the vacuum melted specification.

Mr. Richmond also discussed the increased creep properties of high-temperature alloys due to the presence of minute quantities of boron and zirconium. Although the reason for this has only been explained in theory, the effect of these elements on creep-rupture strength is remarkable.

Exactly why vacuum melted material exhibits increased strength and ductility properties is also questionable. However, Mr. Richmond brought out the point that the superior end product is probably the result of a combination of such criteria as controlled raw material selection, reduction in gas content by the vacuum melting process, increase in total alloy content, better ingot solidification in the case of vacuum-arc melting, and improved techniques of fabrication and heat treatment.

Mr. Richmond closed his interesting talk with several slides illustrating the "In-Fab Room" which his company is constructing in Bridgeville, Pa. This room will contain an inert atmosphere and will be used for the fabrication of molybdenum and other alloys.—**Reported by W. A. Gowder for New Jersey.**

Discusses Metals for Use Above 1500° F. in Delaware

Speaker: N. J. Grant

Massachussetts Institute of Technology

N. J. Grant, professor of metallurgy, Massachusetts Institute of Technology, spoke at the monthly meeting of the **Wilmington Chapter** on "Metals for Use Above 1500° F."

Dr. Grant reviewed the present status of alloys usable at temperatures in excess of 1500°F., pointing out the limitations of these materials. New approaches to the problem of developing materials suitable for even higher temperatures were also reviewed and a detailed discussion presented on applying the principle of strengthening through the presence of a dispersed phase. This principle, well known in SAP, holds promise for systems other than Al_2O_3 in Al. This principle of strengthening, in many ways analogous to precipitation hardening, when applied to cobalt or nickel-base alloys, holds promise for materials useful at temperatures as high as 2300°F.

Much of the impetus for research along these lines is a result of the needs involved in developing high-efficiency gas turbines and rocket engines.—**Reported by N. E. Whitcomb for Wilmington.**

IMPORTANT MEETINGS *for May*

Apr. 30-May 1—Metal Powder Association. Annual Meeting and Exhibit, Drake Hotel, Chicago. (Kempton H. Roll, Secretary M.P.A., 130 W. 42nd St., New York 36).

May 1-3—Society for Experimental Stress Analysis. Annual Meeting, Hotel Statler, Boston. (W. M. Murray, Secretary, S.E.S.A., P. O. Box 168, Cambridge 39, Mass.)

May 5-7 — National Tool and Die Manufacturers Association. Spring Meeting, Mayflower Hotel, Washington. (G. S. Eaton, Executive Secretary N.T.D.M.A., 907 Public Square Bldg., Cleveland 13).

May 5-9—American Ceramic Society. Annual Meeting, Statler Hilton Hotel, Dallas, Tex. (C. S. Pearce, Secretary A.C.S., 2525 N. High St., Columbus 2, Ohio)

May 6-10—American Foundrymen's Society. Annual Meeting and First Engineered Castings Show, Music Hall, Cincinnati, Ohio. (W. W. Maloney, Secretary A.F.S., Golf & Wolf Rds., Des Plaines, Ill.)

May 12-16—Electrochemical Society Inc. Spring Meeting, Hotel Statler, Washington. (H. B. Linford, Secretary E.S., 216 W. 102nd St., New York 25).

May 19-22 — Industrial Heating Equipment Association Inc. Semi-Annual Meeting, Homestead, Hot Springs, Va. (C. L. Ipsen, Executive Vice-President I.H.E.A., Associations Bldg., Washington 6, D.C.)

May 22-23—American Iron and Steel Institute. Annual Meeting, Waldorf-Astoria Hotel, New York, (G. S. Rose Secretary A.I.S.I., 150 E. 42nd St., New York 17).

May 22-24 — American Society for Quality Control. Annual Convention and Exposition, Masonic Temple, Detroit. (Information: Andrews, Bartlett & Assoc., Inc., 1849 W. 24th St., Cleveland 13).

Electron Metallography Techniques Explained at Rocky Mountain Meeting

Speaker: W. L. Grube
General Motors Corp.

William L. Grube, past-president of the Electron Microscope Society of America, spoke on "Electron Metallography" at a meeting of the **Rocky Mountain Chapter.** Mr. Grube is supervisor of the physics of solids section, physics and instrumentation department, General Motors Research Staff.

Mr. Grube pointed out that there are three steps involved in obtaining usable results from work with the electron microscope. Each step presents its own problems and demands that certain techniques be mastered before the end result is satisfactory. The steps involved are: (1) proper preparation of the specimen; (2) faithful replication of the specimen; and (3) correct interpretation of the results.

In preparing the specimen it is necessary to exercise extreme care to avoid inducing microstructural changes. It was pointed out that in some cases mechanical polishing may cause undesirable effects such as phase changes or distortion of the microconstituents. While it is possible to prepare a specimen for electron metallography solely by mechanical means, other methods, such as chemical or electrochemical polishing, should be exploited whenever possible. A variety of etching reagents are employed in specimen preparation—the governing factor being the development of a satisfactory surface relief on the specimen.

The specimen used in the electron microscope must be reasonably transparent to a 50 kilovolt electron beam. Since thick metal specimens do not meet this requirement it is necessary to prepare replicas with materials which do fulfill this need and which, at the same time, will reproduce microstructural detail faithfully. Currently the types of material most generally used include amorphous oxide films, certain plastics, metals and carbon. While these materials are satisfactory, continued effort is required to improve the methods of making replicas.

Interpreting structures correctly, at the very high magnifications possible with the electron microscope, requires training, practice and a systematic approach. In the course of the lecture, Mr. Grube illustrated how this problem is attacked and how the necessary experience is attained. Having done this, he proceeded to discuss and illustrate how electron metallography is being applied in current metallurgical research studies such as carbide precipitation during the early stages of tempering of steel, precipitation in aluminum alloys, deformation and age hardening in heat resistant alloys. The value of "extraction replicas" for this work was also emphasized. In this type of replica some of the particles of the distributed minor phases are removed with the replica thereby making it possible to identify the minor phase particles by transmission electron diffraction.

Mr. Grube also touched briefly on the newer types of electron microscopes and mentioned Muller's field-ion microscope wherein magnifications of five million times have been achieved. Such magnifications make it possible to observe atom sites in metal crystals.—**Reported by V. D. Heinze for Rocky Mountain.**

At Montreal's President's Meeting

Shown at the Presidents' Night Meeting Held by the Montreal Chapter Are, From Left: R. W. Bartram, President, Robert W. Bartram Ltd.; John M. Bishop, President, Accessories Manufacturers Ltd.; H. Greville Smith, President, Canadian Industries Ltd.; Stuart Armour, Economic Adviser, Steel Co. of Canada, Ltd., K. Barwick, President, Henderson, Barwick Co., Ltd.; and Arnold H. Boehm, Chapter Chairman

Speaker: S. Armour
Steel Co. of Canada, Ltd.

Canada is in a vulnerable economic position when it must rely upon incoming foreign capital to make up a trade deficit of $1,000,000,000, Stuart Armour, economic adviser to the president, Steel Co. of Canada, Ltd., told the **Montreal Chapter** at the annual Presidents' Night meeting.

All the presidents or senior executives of the sustaining members were invited as guests of the Chapter to attend the dinner meeting at which Mr. Armour warned of problems facing Canadian industry in a talk entitled "The Burdens We Bear".

With what has been described as the world's most elaborate program of state welfare to support by high taxes, industry has to compete with low-cost foreign industries which have virtually unimpeded entry to the Canadian market.

Without tax reduction there is very grave doubt in the minds of many as to how the anticipated progress can be financed save by ruinous inflation, Mr. Armour concluded.

An outstanding coffee talk film entitled "Passage and Power" was shown by the Canadian General Electric Co. Ltd. The film showed the economic effect the Great Lakes and St. Lawrence River have had on the development of Canada.—**Reported by D. F. Cornish for Montreal.**

Calumet Entertains Ladies

A "Fun With Music" program was presented by Harry Kennard and Anthony Bobis of Lyon & Healy Co. at the annual Ladies Night meeting of the **Calumet Chapter.**

Mr. Kennard conducted the gathering as an imaginary travelogue which covered the principal cities and countries of the world. At each stop on the itinerary, he would discuss the habits and customs which are peculiar to that section of our universe. To add local color, Mr. Bobis played the type of music which is characteristic of each of the places visited.

The journey covered 15 different countries including the Orient, the Holy Land, Europe, the British Isles and various sections of the United States. During the trip, Mr. Bobis entertained the group with renditions ranging from the older classical waltzes of Vienna to the currently popular swing music of the United States.

Each lady guest was presented with a favor and door prizes were distributed. — **Reported by J. W. Luoma for Calumet.**

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared at the Center for Documentation and Communication Research,
Western Reserve University, Cleveland,
With the Cooperation of the John Crerar Library, Chicago.

Annotations carrying the designation (CMA) following the reference are published also in *Crerar Metals Abstracts*.

General Metallurgy

121-A. Trends in Air Pollution—1956. Wesley C. L. Hemeon. *Blast Furnace and Steel Plant*, v. 45, Feb. 1957, p. 204-208.

Developments of past four years of interest to the steel industry. Summary of A.I.S.I. research program. 7 ref. (A8; ST)

122-A. Operational Research in the Iron and Steel Industry. H. G. Jones. *Iron and Coal Trade Review*, v. 174, Jan. 11, 1957, p. 97-102.

Some of the points of contact between operational research and work study, tools of operational research, analysis of uncontrolled data and method study of machines. (A9n; ST)

123-A. Molybdenum for High Strength at High Temperature. R. R. Freeman and J. Z. Briggs. *Jet Propulsion*, v. 27, Feb. 1957, p. 138-147. See also: **High-Temperature Strength Characteristics Indicate New Applications for Molybdenum Alloys.** R. R. Freeman and J. Z. Briggs. *Machine Design*, v. 29, Feb. 21, 1957, p. 137-138, 140, 142, 144. (CMA)

Molybdenum, of interest to missile and power plant designers, is available as four high-strength, high-temperature alloys: 0.5% Ti, 0.3% Nb, 1% V and 2% W. Physical properties are not much affected by alloying or processing, but mechanical properties are. Worked and stress-relieved Mo-0.5% Ti has the best high-temperature properties. Protective coatings may be the solution to oxidative attack; requirements of successful coats are enumerated. Molybdenum parts are produced by forging bar stock, but forming is best for ramjet parts. Minimizing embrittlement in welding is discussed. 7 ref. (A general; Mo, SGA-h, SGB-a)

124-A. Further By-Product Minerals. *Mining Journal*, v. 248, Jan. 18, 1957, p. 81.

Sources and applications of rhenium, rubidium, scandium and tellurium. (A11a, T general, Re, Rb, Sc, Te, 14-9)

125-A. Century of Aluminum. George Boex and Stanley Robson. *Royal Institution of Great Britain, Proceedings*, v. 36, Part I, no. 162, p. 70-105.

Historical review, with emphasis on applications of aluminum and changing market conditions over the years. 14 ref. (A2, T general; Al)

126-A. Ideas for Waste Treatment. *Steel*, v. 140, Feb. 18, 1957, p. 150-154.

Efficient and safe methods of treatment or disposal for acids, alkalies, heavy metals, cyanides or miscellaneous other wastes are receiving increasing consideration from industry in effort to reduce costs. (A8)

127-A. (French.) Interesting Possibilities Offered by Titanium, a Light-Weight Material With High-Quality Mechanical Performances. G. Grandvoinnet. *Revue Générale de Mécanique*, v. 41, Jan. 1957, p. 19-22. (CMA)

Properties, metallurgy and costs of production of titanium briefly outlined, table is presented giving names, composition, thermal treatment and characteristics of nine titanium alloys manufactured or to be manufactured in 1957 in France. (A general; Ti)

128-A. Titanium in Canada—1956. T. H. Janes. *Canadian Mining Journal*, v. 78, Feb. 1957, p. 130-132. (CMA)

A survey of world titanium ore resources, ilmenite deposits, production and shipments from Lake Allard, titanium pigment industry in Canada and the U.S., Canadian fabrication and working of titanium. Kennecott Copper-Allied Chemical and Dye project to produce $TiCl_4$ and titanium metal is of interest in Canada because titaniferrous slag from Lake Allard may be a raw material. (A general; Ti)

129-A. Stainless Steel From the User's Point of View. H. J. Wilson. *Chemical and Process Engineering*, v. 38, Jan. 1957, p. 5-10.

Types, problems of design and construction, corrosion and abrasion resistance. Some examples of stainless steel construction. (A general; SS)

The subject coding at the end of the annotations refers to the revised edition of the ASM-SLA Metallurgical Literature Classification. The revision is currently being completed by the A.S.M. Committee on Literature Classification, and will be published in full in late spring or early summer. A schedule of the principal headings in the revised version was published in the February issue.

130-A. Metallurgy. H. A. Holden. *Chemical and Process Engineering*, v. 38, Jan. 1957, p. 15-18.

Review of the development and uses of steel, magnesium, titanium and other miscellaneous metals. 58 ref. (A general)

131-A. Titanium From a Business Standpoint. H. H. Kellogg. *Metal Progress*, v. 71, Feb. 1957, p. 128, 130, 132. (From *Engineering and Mining Journal*, v. 156, Apr. 1955, p. 72-84.) (CMA)

Various problems noted: solid solution of the oxide in the metal, high price, limited supply, selection of best process. It is predicted that titanium mill products will sell for $2 per lb. when the industry is mature. Kroll process sponge and ingots will be available at $1.15 to $1.30 per lb. (A4s; Ti)

132-A. Long-Term Outlook for Copper. Robert P. Koenig. *Mines Magazine*, v. 47, Jan. 1957, p. 16-18, 32.

Increased demand for primary products, prospects for improved copper supplies, dynamics of copper-consuming industries and prospects for increased copper demand. (A4p; Cu)

133-A. Titanium 1956-1957. C. U. Bradford. *Mining Congress Journal*, v. 43, Feb. 1957, p. 113-114. (CMA)

Notable occurences in the titanium industry in 1956 included a 300% leap in demand due to use in several types of aircraft. Melting capacity has been increased by the four major fabricators of titanium, and research programs made great progress. Many new uses were developed in chemical process industries. By the end of 1957 sponge capacity is expected to be 36,500 tons yearly. (A general; Ti)

134-A. Zirconium Arrives. *Steel*, v. 140, Feb. 25, 1957, p. 56-57. (CMA)

Zirconium has both nuclear and commercial applications, but the best chance of a rapid industrial expansion is with the former. Delivery of the hafnium-free nuclear grades will rise sharply in 1957 as new plants begin production (i.e., Carborundum Metals, U.S. Industrial Chemicals, NRC Metals and Wah Chang Corp.). Cost and capacity figures presented. (A4p; Zr)

135-A. Mineral-Dressing Study of Manganese Deposits of the Batesville, Ark., District. M. M. Fine. *U.S. Bureau of Mines, Report of Investigations* 5301, Jan. 1957. 12 p.

Research on manganese-bearing limestone indicates that this resource constitutes one of the major domestic reserves. Ferrograde concentrates can be recovered from the samples tested. (A11a, B11; Mn)

136-A. (French.) Fluctuations of World Production of Nickel and Their Effect on Special Steels. André Michel. *Métallurgie et la Construction Mécanique* v. 89, Jan. 1957, p. 33-41.

Problems arising from the nickel shortage. Maintains that nickel can be saved in the manufacture of stainless steel and refractory steel by substitution of chromium or by keeping it to the austenitic structure, either by acting on the nitrogen content or by the use of manganese. Contains detailed descriptions of chromium-nickel and chromium-manganese-nickel stainless steels. (A11b; Ni, SS)

137-A. (French.) Aluminum Situation at the Beginning of 1957. André Dumas. *Revue de l'Aluminium,* no. 239, Jan. 1957, p. 45-47.

Unique properties of aluminum; widespread domestic and industrial applications; progress in production techniques; figures indicating extent of French production; expansion prospects as seen by the manager of L'Aluminium Francais. (A general; Al)

138-A. (German.) Austrian Uranium Sources and Their Outlook. Heinz Meixner. *Berg und Hüttenmannische Monatshefte,* v. 101, Nov. 1956, p. 223-228.

Geographical distribution of different uranium ores in Austria. 21 ref. (A11a; U)

139-A. (German.) Metallurgy of Beryllium. Willy Schreiter. *Freiberger Forschungshefte,* v. B17, Oct. 1956, p. 50-77.

Mining of ore, extraction of metallic beryllium, preparation of beryllium-copper alloy, smelting, sintering, beryllium oxide, beryllium carbide, application in atomic energy as moderator and reflector, toxicology. 30 ref. (A general; Be)

140-A. (Italian.) Achievements and Objectives of Italian Metallurgy in the Nonferrous Field. C. Panseri. *Metallurgia Italiana,* v. 48, Dec. 1956, p. 561-574.

Copper, zinc, lead, silver, cadmium, aluminum production and principal methods of refining used; perspectives for fulfilling more of domestic requirements. Tables and other data on prices, production, consumption, export-import. (A4p, C general; EG-a38)

141-A. (Japanese.) Borides, Carbides, Silicides, and Nitrides. Tadao Tomonari. *Chemical Society of Japan, Journal, Industrial Chemistry Section,* v. 59, Nov. 1956, p. 1272-1278. (CMA)

Rare element compounds of boron, carbon, silicon and nitrogen which are stable and which form solid solutes are listed, and their crystalline classifications are given. Preparation methods, properties and uses reviewed. 15 ref. (A general; EG-b, 14-18)

142-A. (Japanese.) Purity of Selenium and Its Application. Takeo Nakogawa. *Denki Kagaku,* v. 24, Nov. 1956, p. 529-533.

Properties, refining and application of selenium. 15 ref. (A general; Se)

143-A. (Russian.) Problem of the Toxicity of Metallic Magnesium. E. M. Kakauridze, P. F. Labadze and T. A. Kakuliya. *Gigiyena i Sanitariya,* v. 21, Nov. 1956, p. 73-74.

Results of clinical observation of a number of workers employed at a shop where parts from magnesium alloys containing 89.7 to 91.65% of metallic magnesium were manufactured. All the workers examined suffered from dryness in the nasopharynx area, frequent catarrh, loss of hair, dry skin and scabies. (A7; Mg)

144-A. Production and Fabrication of New AISI Types 201 and 202. G. W. Hinkle. *ASTM Bulletin,* no. 220, Feb. 1957, p. 47-50.

Melting procedure, blooming mill operation, forging, machining, annealing, pickling, roll forming, deep drawing, polishing, welding and stress cracking of AISI 201 and AISI 202 alloys (low nickel stainless steels). (A general; SS)

145-A. Uranium in Canada—1956. R. A. Simpson. *Canadian Mining Journal,* v. 2, Feb. 1957, p. 129-130.

Occurrence, mining, uses and future of uranium in Canada. (A general; U)

146-A. Titanium in the Aircraft Industry. *Engineer,* v. 203, Feb. 22, 1957, p. 295-297.

Imperial Chemical Industries called a conference of representatives of the British government and aircraft industry. Industrial statistics were quoted. The wrought titanium forms available to the aircraft industry were described and considered. Subjects covered at the conference were stress specifitions, formability, scrap reclamation, fatigue in titanium tubes, development of high-strength sheet alloys. British sales of titanium are analyzed. (A general, T24; Ti)

147-A. Mineral Wealth of India. G. G. K. Sastri. *Indian Minerals,* v. 10, July-Sept. 1956, p. 220-232.

Mineral resources of India classified under metallic minerals, nonmetallic minerals, mineral fuels and atomic minerals. Among Indian minerals of world importance are mica, iron ore, manganese ore, ores of aluminum, magnesium, titanium, high-grade refractories, thorium and other atomic minerals. (A11a; 14.9)

148-A. Special Cutting Table "Clears the Air". *Industry and Welding,* v. 30, p. 82-84.

Colonial Iron Works, Cleveland, Ohio, solves problem of removal of smoke produced by the powder burning process used in the torch cutting of metals. (A8a, G22g)

149-A. Titanium: Are Prices Coming in Reach? G. J. McManus. *Iron Age,* v. 179, Feb. 28, 1957, p. 40-41. (CMA)

Cost cutting in the titanium industry is now taking the form of increased scrap use: Rem-Cru has installed a furnace which will remelt scrap and Mallory-Sharon is developing a method of electrolytically refining scrap. Titanium is emerging as a separate industry with its own rolling and fabricating facilities as evidenced by new TMCA equipment. A tight titanium supply last December caused the Air Force to supervise distribution. About 70% of titanium for military use goes to jet engines and 25% to airframes. (A4s, B23; Ti)

150-A. Technical Development in the Steel Industry: Some Lessons From Sweden. D. J. O. Brandt. *Iron and Coal Trades Review,* v. 174, Jan. 25, 1957, p. 197-200.

Considerable difficulties have had to be surmounted in obtaining adequate supplies of fuel in Sweden. The author considers some of these difficulties, and suggests that overcoming them has bred a fine tradition of enterprise and inventiveness which are worth emulating; the fuel problem, sponge-iron process and Swedish research organization are described. (A11a, A9, D8j; ST, RM-j)

151-A. New Cutting Steels. *Mass Production,* v. 33, Feb. 1957, p. 68-71.

New Wimet cutting steels "XL2" and "XL3" extend the range of grades with extended wear. (A general, Q9n; ST, SGA-j)

152-A. The Aluminum Supply Position. E. G. West. *Metallurgia,* v. 55, Feb. 1957, p. 55-62; disc. p. 90.

Summary of recently published information on ingot capacity. Production and consumption in principal countries. Increasing tendency to establish smelters near the raw material deposits on which trend nuclear power may have considerable bearing. (A4p; Al)

153-A. High Strength Aluminum Casting Alloy 40-E:D.T.D.5008: Latest Developments and Foundry Experience. J. F. Gardner and M. R. Hinchcliffe. *Metallurgia,* v. 55, Feb. 1957, p. 79-84.

Alloy employs zinc, magnesium, chromium and titanium as alloying constituents. An outline of the properties is given. Melting and casting characteristics, typical applications. (A general, E general; Al, SGB-a)

154-A. Special Metals and Rare Earths. Eugene B. Hotchkiss. *Mining Congress Journal,* v. 43, Feb. 1957, p. 76-78.

Availability and importance of the rare earths and a number of other metals, including zirconium, beryllium and uranium. (A11a; EG-g, Zr, Be, U)

155-A. Titanium—1956-57. C. I. Bradford. *Mining Congress Journal,* v. 43, Feb. 1957, p. 113-114.

The use of titanium tripled in 1956, new applications being heat exchangers, reactors, mixers, pumps, valves and marine hardware. Important research on cold mold and unconventional melting is also cited. (A general, T general; Ti)

156-A. (French.) Some Generalities on Titanium and Its Metallurgy. Marcel Fourment. *Société Royale Belge des Ingénieurs, Revue,* no. 2, Feb. 1957, p. 51-61. (CMA)

Outline of the main facts concerning the properties, ores and metallurgy of titanium. The section on metallurgy mentions two procedures for refining metallic titanium: the method of thermal dissociation of titanium iodide, and the method of progressive liquation of titanium bars. (A general, C1p, C28k; Ti)

157-A. (Italian.) Past, Present and Future of the Italian Steel Industry. A. Scortecci. *Metallurgia Italiana,* v. 48, Dec. 1956, p. 545-560.

Production of iron and steel in Italy from Roman times to present. Development of steelmaking techniques, with table of important dates (world-wide) in history of iron and steel. Problems of coke supply, utilization of "poor" metals, blast furnace developments in main steel producing countries of the world. Economic aspects and importance of professional personnel. 24 ref. (A2, P4, D general; ST)

158-A. (Book.) Tool and Die Steels Handbook, 1956. Jessop-Saville, Sheffield, England, 79 p.

Contains information for the toolmaker relative to the composition, characteristics, quality and properties of specialized steels used in tool and die operations. (A general; TS)

159-A. (Book—French.) **Study and Design of Light Alloy Structures.** J. Reinhold. 248 p. 1955, Librairie Polytechnique Ch. Beranger, Paris, France.

Outlines physical, chemical, electrical and mechanical properties of aluminum and its alloys indicating the principal applications of each alloy; analyzes in detail the mechanical principles underlying aluminum structural design such as shearing stress, failing stress, shape factors and radius of gyration; concludes with a sketch of the casting, working, welding and finishing of aluminum and light alloys. (A general, Q general, 17-1; Al, SGB-s)

160-A. (Book—Italian.)**A Biography of Metals.** Felice de Carli. 269 p. 1956. Casa Editrice Dr. Francesco Vallardi, Milan, Italy.

Story of metals from earliest known uses and workings to present day, written for the layman. Emphasis on influence of metals on man and his environment, and of man's needs on development of metallurgical sciences. Basic information on technological aspects. (A general)

B Ore and Raw Material Preparation

20-B. Concentration of Tin Alluvial From Shaw River, W.A. K. Blaskitt. *Australian Scientific and Industrial Research Organization, Ore Dressing Investigations Report No. 521,* April 56, 8 p.

Recoverable tin in the sample is about 0.1%. More than half is finer than 25 mesh. (B14; Sn, 14-9)

21-B. Automatic Control of the Grinding Circuit at Marmora Concentrator. P. L. Steffensen and W. M. Aubrey. *Mining Engineering,* v. 9, Jan. 1957, p. 61-64.

Flow sheet and operating data of control system developed to maintain grinding analysis within narrow limits for ball mills in closed circuits with cyclones. Used at Marmora for concentrating treatment of magnetite ore. (B13c; Fe, RM-n)

22-B. Studies on the Beneficiation of Low Grade Ores by Flotation. N. R. S. Srinivasan and H. S. Aswath. *Indian Institute of Science, Section B, Journal,* v. 38, July 1956, p. 135-142.

Separating quartz and gangue from beryl in low-grade beryl ores by froth flotation. The separation of quartz was attempted by (1) flotation of quartz at a pH of above 11 using oleic acid and terpinol, barium chloride as activation for quartz and alizarin red-sulphur as depressant for beryl, and (2) flotation of beryl at about pH 6 by using only oleic acid and terpineol. A concentrate of 11% beryllium oxide was made at 84% recovery. 20 ref. (B14h, Be, RM-n)

23-B. Uranium-Aluminum Alloy Dissolution. Some Basic Factors in Processing Spent Nuclear Fuel. R. G. Wymer and R. E. Blanco. *Industrial and Engineering Chemistry,* v. 49, Jan. 1957, p. 59-61.

Nitric acid-mercuric nitrate system, effect of mercury concentration, stoichiochemistry of the catalyzed dissolution, caustic system, effect of dissolvent impurities and dissolution of uranium solids. Process used to remove jackets from reactor core materials. (B23, T11g; U, Al)

24-B. (English.) **Studies on the Metallurgy of Antimonial Ores Bearing Gold and Silver.** Tatsuo Matsukawa and Tosiyuki Sakai. *Osaka University Technology Reports,* v. 6, Mar. 1956, p. 123-131.

The roasted residues from Herrenshmidt roaster, which contain gold and silver, are not amenable to ordinary cyaniding. If the roasted residues are roasted with 8 to 10% caustic soda, the extraction of gold increases to 97% and that of silver to 82%. 6 ref. (B15, C19pi; Au, Ag)

25-B. The Uranyl-Ammonium Phosphate Process for Recovery of Uranium From Slag Scrap. E. R. Johnson, E. O. Rutenkroger, A. B. Kreuzmann and B. C. Doums. *Chemical Engineering Progress,* v. 53, Feb. 1957, p. 56F-59F.

The phosphate precipitation process has been successful in recovering uranium from magnesium fluoride slag in yields in excess of 98%; equipment and process are described. 6 ref. (B23, C19; U, RM-q)

26-B. Uranium Recovery From Aqueous Wastes. R. J. Clouse, J. Dyksta and B. H. Thompson. *Chemical Engineering Progress,* v. 53, Feb. 1957, p. 65F-69F.

Solutions derived from equipment cleaning at the gaseous diffusion plant contain isotopically enriched uranium. The facility for recovering this uranium, processing it to an oxide, fluorinating the oxide to uranium hexafluoride is reviewed. (B23, C6b; U)

27-B. (German.) **Production and Application of Foamed Slag.** Walter Ruopp. *Stahl und Eisen,* v. 77, Jan. 10, 1957, p. 36-43.

Differences in various methods for the production of foamed slag. Review on the processes used thus far. Application as a lightweight insulation material and for concrete cast in site. (B23; RM-q)

28-B. (Book—German.) **Flotation.** A. W. Troizki. 215 p. 1956. Fachbuchverlag, Leipzig, Germany.

Survey of flotation and equipment used in flotation plants in the Soviet Union. Covers preparatory processes, ore dressing and production control. Translation from the Russian, originally published by Verlag Metallurgisdat, Moscow, 1948. (B14h)

C Extraction and Refining

66-C. Preparation of Rare Earth Concentrates. D. C. Stewart and J. P. Faris. *Journal of Inorganic and Nuclear Chemistry,* v. 3, Aug. 1956, p. 64-66. (CMA)

In recovering mixed yttrium-group lanthanons (Gd-Yb) with a type of ion-exchange resin column from a large glycollic acid solution, it was found that a crude separation was effected. Data show an apparent tendency in each run for a given lanthanon to act "pivotally", depending on the composition of the mixture. (C19s; EG-g)

67-C. Separation of the Lanthanides by Ion Exchange With Alpha-Hydroxy Isobutyric Acid. G. R. Choppin and R. J. Silva. *Journal of Inorganic and Nuclear Chemistry,* v. 3, Sept. 1956, p. 153-154. (CMA)

A Dowex-50 X-12 (400-mesh) resin was used in ion exchange separation of the lanthanons with ammonium α-hydroxy isobutyrate. The large separation factors necessitated a number of elutions using combinations of three to five neighboring lanthanons. Various molarities and acidities favor separation of different groups. The flow rate with α-hydroxy isobutyric acid is five times that with EDTA. Conditions necessary for dimer formation should be avoided. (C19s; EG-g)

68-C. Electrolytic Separation of Metallic Isotopes. James H. Andrews, Ivan Ceresna, F. A. Rohrman and William F. Utlaut. Chemical Engineering Progress, Symposium Series, *Nuclear Engineering,* Part II, v. 52, no. 19, 1956, p. 49-52.

By use of nickel-63 as a radioactive tracer it was found possible with electrochemical technique to enrich the concentration of nickel in the cathodic deposit. 5 ref. (C6; Ni)

69-C. Vacuum Melted Alloys for Forged Parts. W. W. Dyrkacz and E. E. Reynolds. *Product Engineering,* v. 28, Feb. 1957, p. 143-145.

Advantages and limitations of consumable electrode and induction heating processes; effect on cleanliness, segregation, and elevated-temperature properties; relative costs and growing fields of use. (C5h, C5j, 1-23)

70-C. (French.) **Modern Processes of Obtaining Pure Metals.** Claude Bertrand. *Nature,* no. 3261, Jan. 1957, p.

Influence of impurities on physical, electrical, mechanical and various properties of metals; determination of amounts of impurities; outline of principal methods of refining metals. (C28, P general, Q general, 3-19)

71-C. Recovery of Uranium From Phosphate Rock. R. E. Stedman. *Chemistry and Industry,* no. 6, Feb. 9, 1957, p. 150-153.

Method of recovery of uranium from solution by chemical precipitation. (C27; U)

72-C. Equilibrium Between Titanium Metal, Titanium Dichloride, and Titanium Trichloride in Molten Sodium Chloride-Strontium Chloride Melts. S. Melgren and W. Opie. *Journal of Metals,* v. 9, Feb. 1957, p. 266-269. (CMA)

In the electrolytic deposition of titanium from a fused salt bath, an important equilibrium is that which exists in the reaction $3TiCl_2 \rightleftarrows 2TiCl_3 + Ti$. The present study indicates that the equilibrium existing in a fused $NaClSrCl_2$ bath containing titanium, Ti^{+2} and Ti^{+3} is unaffected by changes in temperature over the 650 to 800° C. range or in total titanium concentration in the range 1.7 to 5.0%. There is a slight trend for the equilibrium constant $K = (N_{TiCl_3})^2/(N_{TiCl_2})^3$ to decrease with increasing titanium concentration. Varying the $SrCl_{2_{NaCl}}$ ratio has a great effect on the equilibrium. In the course of the study an analytical method for $TiCl_2$ was developed, based on hydrogen evolution from a weak HCl solution. (C23p; Ti)

73-C. Preparation of High-Purity Electrolytic Chromium. P. M. Gruzensky and F. E. Block. *U.S. Bureau of Mines, Report of Investigations* 5305, Jan. 1957, 11 p.

Preparation of the metal by electrolysis of chromic acid solutions and determinations of the conditions that yield optimum results. The apparatus is described, as well as the parameters that received consideration. Ion exchange resins were employed to remove cation impurities from the electrolyte. 15 ref. (C23p, C19s; Cr)

74-C. (French.) **The Present State of Nickel Production Techniques.** L. F. Denaro. *Métallurgie et la Construction Mécanique,* v. 89, Jan. 1957, 25-31.

History of nickel production; various categories of ores; refining processes used for sulphuretted ores and oxidized ores; statistics concerning world trade and consumption of nickel. (C general, A4p; Ni, RM-n)

75-C. (German.) **Manufacture of Calcium Metal. I. Electrolytic Process.** Guenther Wehner. *Freiberger Forschungshefte,* v. B17, Oct. 1956, p. 18-33.

A new process of manufacturing calcium metal which consists of electrolyzing molten calcium chloride at a copper cathode, and obtaining thereby a copper-calcium alloy which is decomposed by means of vacuum distillation (section II below). (C23g; Ca)

76-C. (German.) **Manufacture of Calcium Metal. II. Distillation Process.** Hellmuth Seliger. *Freiberger Forschungshefte,* v. B17, Oct. 1956, p. 34-49.

A method of purification of the product in section I (above) based on the fact that the easily volatilized calcium is separated by evaporation from the less volatile impurities which remain as a residue. 1 ref. (C22h; Ca)

77-C. (Japanese.) **New Quantitative Precipitation of Thorium and Rare Earths From a Homogeneous Solution, and Its Application to the Extraction of Some Elements From Ores.** Zenzi Hagiwara. *Chemical Society of Japan, Journal, Industrial Chemistry Section,* v. 59, Dec. 1956, p. 1378-1383. (CMA)

Monazite and bastnaesite were used, and diethyloxalate was newly adopted as a precipitating agent. A mixture of perchlorate-sulphuric acid, or simply perchlorate, was used to decompose the monazite, and extraction rates of rare earths and thorium were sought. Conditions of the basic experiments were employed in incorporating new methods for determination of these substances in monazite sand. 10 ref. (C27, S11; Th, EG-g)

78-C. (Japanese.) **Studies on Electrolytic Refining of Aluminum at Low Temperature in Aluminum Chloride Baths (Part II). Influences of Alternating Current Superposed on Aluminum Deposits, and Unusually High Current Efficiencies.** Rinzo Midorikawa. *Denki Kagaku,* v. 24, Nov. 1956, p. 511-515.

Attempts to prevent the aluminum electrodeposits from developing irregular crystals; superposition of 500 cycles alternating current on applied 60 cycles. 10 ref. (C23p; Al)

79-C. Reactor Grade Uranium by Extraction of Slurries. D. S. Arnold and B. G. Ryle. *Chemical Engineering Progress,* v. 53, Feb. 1957, p. 63F-64F.

Investigation of the refining of a number of uranium ores by solvent extraction of slurries by digesting the ore concentrate in nitric acid producing uranium of reactor grade. Various impurities in ores can greatly affect product recovery, product purity and refinery operations. (C19; U)

80-C. Preparation of Power Reactor Fuels for Aqueous Processing. J. E. Savalainan and R. E. Blanco. *Chemical Engineering Progress,* v. 53, Feb. 1957, p. 78F-81F.

Converting fuels fabricated in nitric acid insoluble metals to nitric acid solutions suitable for reprocessing by solvent extraction. The Darex process uses dilute aqua regia to dissolve stainless steel fuels and distillation to recover hydrochloric acid and nitric acid in titanium equipment. The Zircex process uses hydrogen chloride gas or a liquid inorganic chlorinating agent to remove selectively zirconium from jacket or core alloys at 300-400° C. as volatile zirconium tetrachloride. (C19, T11; SS, Zr)

81-C. Pure Rare Earths by Ion Exchange. T. F. Meinhold and H. E. Kremers. *Chemical Processing,* v. 20, Mar. 1957, p. 12-13, 18-19. (CMA)

Ion exchange process for separating the lanthanons reviewed. Some of the individual metals are thus made available in commercial amounts. Lindsay Chemical Co. markets the lanthanons. (C19s; EG-g)

82-C. Electrodeposition of Uranium at the Microgram Level. C. L. Rulfs, A. K. De and P. J. Elving. *Electrochemical Society, Journal,* v. 104, Jan. 1957, p. 80-83.

Recovery of microgram and submicrogram quantities of uranium by electrodeposition has been studied, using radioactive uranium 233 as a tracer with and without the presence of microgram quantities of natural uranium as carrier. Optimum results were obtained in an ammonium oxalate medium with electrolysis at 80-85° C. 14 ref. (C23p, A11d; U)

83-C. Mineral Digest—Aluminum. *Indian Minerals,* v. 10, July-Sept. 1956, p. 263-271.

Extraction of alumina; composition of aluminum ores such as bauxite, alumite and aluminous fireclays. (C general; Al, RM-n)

84-C. An Investigation of the Iodide Method of Refining Zirconium—II. Lower Zirconium Iodides and the Influence of Tetra-Iodide Pressure Upon the Rate of Metal Deposition. V. S. Emelyanov, P. D. Bystrov and A. I. Evstyukhin. *Journal of Nuclear Energy,* v. 4, no. 1. (Part II. *Soviet Journal of Atomic Energy,* v. 1, no. 3), Feb. 1957, p. 253-261. (CMA)

In the iodide refining of zirconium the lower iodides forming on the metal surface do not interfere with deposition, except that they change the vapor pressure and therefore the deposition rate. Rate reduction comes about through a decrease in the diffusion coefficient at increased pressures. (C1p; Zr)

85-C. Electrolytic Titanium—I. R. S. Dean. *Metal Industry,* v. 90, Feb. 22, 1957, p. 143-146. (CMA)

Development by Chicago Development Corp. of a process for electrorefining titanium scrap. Process entails the production of both reactants in the cell; the product is a powder. The oxygen problem is considered and measurements are given of the potential on titanium-oxygen alloys in the beta region in four electrolytes. The salt bath electrolytes (containing in general lower titanium chlorides and mixtures of two or more of sodium chloride, potassium chloride, lithium chloride). (C23p; Ti, RM-p)

86-C. Radiochemical Procedure for Individual Rare Earths. L. R. Bunney, et al. *Nucleonics,* v. 15, Feb. 1957, p. 81-83. (CMA)

A procedure for isolating, purifying, separating by ion exchange and precipitating individual lanthanons. Steps in each operation are enumerated. A Dowex-50 resin and lactic acid eluting agent is used; the flow rate is 10-25 ml. per hr. 10 ref. (C19; EG-g)

87-C. Consumable-Electrode Arc Melting of Titanium and Its Alloys. R. W. Huber and I. R. Lane, Jr. *U.S. Bureau of Mines, Report of Investigations* 5311, Feb. 1957, 36 p. (CMA)

A furnace for arc melting titanium and its alloys designed to allow for evacuating to very low pressures and back filling with inert gas for melting at about 1 atm. Vacuum melting was also tested in the furnace, using inert gas to sweep the crucible. The ingot prepared was rolled into plate and subjected to tensile and impact testing. The homogeneity of ingots of Ti-Al (1-7%), Ti-10Sn, Ti-5Sn, Ti5Al-2.5 Sn, Ti-Al-Fe, Ti-Al-Cr, Ti-Al-Mo and Ti-Al-V alloys was studied. (C5h, 1-2; Ti)

88-C. Electrorefining Titanium Metal. J. R. Nettle, D. H. Baker, Jr., and F. S. Wartman. *U.S. Bureau of Mines, Report of Investigations* 5315, Feb. 1957, 43 p. (CMA)

Titanium has been successfully electrorefined in the laboratory by a fused-salt electrolysis with impure scrap or sponge as the anode; pure titanium is collected at the cathode. The cathode current density depends mainly on the amount of soluble titanium chloride in the electrolyte, but the condition of the anode is also influential. Several cells developed in the study are diagrammed and their operation discussed. A number of eutectic mixes of salts were surveyed for the fused bath. (C23p; Ti)

89-C. (French.) **Contribution to the Study of Rare Earths Separation by Ethylenediaminetetra-Acetic Acid.** J. Fuger. *Sociétés Chimiques Belges, Bulletin,* v. 66, no. 1-2, 1957, p. 151-168. (CMA)

It was found that the rare earths ytterium, europium, praseodymium, neodymium, promethium and cerium can be separated by elution with EDTA on a Dowex 50 column with careful pH control. For the more difficult separations, such as ytterium-europium, the optimum pH value is rather critical. Because of the low solubility of EDTA at the optimum pH for the separation of the yttric earths and their high stability with the complexone, they cannot be separated by this method. For the separation of lutecium, thulium, holmium, ytterium, terbium, gadolinium and europium it is suggested that a metallic complex of EDTA be used as the eluent on a Dowex column containing the same metal cation. 8 ref. (C28; EG-g)

90-C. (Book—French.) **Studies on Gallium With a View to Its Extraction During the Fabrication of Alumina.** 149 p. 1956. Imprimerie Vaudoise, Lausanne, Switzerland.

Methods of extracting gallium from the disaggregation lyes during the processing of alumina. Describes a new process, now in a pilot stage, for the extraction of gallium by electrolysis noting the different variables influencing the yield (temperature, current density, etc.). Includes also a bibliographical index listing over 1200 items. (C23p; Ga, Al)

D Iron and Steelmaking

69-D. Manufacture of Special Steels. G. Reginald Bashforth. *British Steelmaker,* v. 23, Feb. 1957, p. 42-48.

Instrumentation, hearth construction and maintenance, charging technique, quality control, melt and slag control, charging procedure, choice of deoxidizers and steel for deep drawing. (D general; ST)

70-D. Basic Bessemer Phosphorus—Relationships With Fe in Slag and O_2 During Final Blow. H. v. Ende and G. Mahn. *Iron and Steel,* v. 30, Feb. 1957, p. 61-63.

A relationship between iron content of the slag, the phosphorus content of the bath and corresponding temperature; increasing amount of iron will go into the slag while the phosphorus content is being decreased. At uniform phosphorus contents an increasing amount of iron will go into the slag with increasing temperature. The temperature was measured with an immersion thermocouple. (D3, 1-15, D11n; Fe)

71-D. Oxygen Speeds Sulphur Removal. *Steel,* v. 140, Feb. 18, 1957, p. 158, 161.

Outlines slag control method for sulphur removal in oxygen reclining procedure with openhearth giving shorter refining time. (D2g)

72-D. (French.) **Industrial Reduction of Iron Ores by Hydrogen.** André Roos. *Génie Civil,* v. 134, Jan. 15, 1957, p. 36-39.

Results of laboratory experiments and industrial applications relating to this process of reduction. (D8j; Fe)

73-D. (French.) **Comparison of the Different Methods of Pulverizing Mazut for the Martin Furnace.** G. Husson, A. Peters, R. Kissel and G. Jomier. *Institut de Recherches de la Siderurgie, Publications,* Ser. A, no. 128, Dec. 1956, p. 256-275.

Study on firing Martin furnaces with Mazut. Evaluation of this fuel on the basis of quantity of steel produced. (D2; RM-j)

74-D. Alloy Steels: Practice at the Clyde Alloy Steel Co., Ltd. *Iron and Coal Trades Review,* v. 174, Jan. 18, 1957, p. 139-144.

History, description and present processes of the company. Research on ingot mold design; conservation practice for metals in short supply. (D general, A11; AY)

75-D. (French.) **Study on Pilot Models of the Aerodynamics of the Martin Furnace.** F. Husson, R. Durand and G. Cohen de Lara. *Institut de Recherches de la Siderurgie (IRSID) Publications, Series* A, No. 127, Dec. 1956, p. 204-227.

Current research into the function and operation of Martin furnaces; notes also the major problems remaining to be solved. (D2, W18)

76-D. (German.) **Special Metallurgical Problems of the Iron Industry in Bosnia.** K. Kapetanovic. *Radex-Rundschau,* no. 8, 1956, p. 367-376.

A historic survey, problems of manganese, methods of steel production, the Talbot process and its adaptation to present working conditions. 2 ref. (D general, A11a; ST)

77-D. (German.) **Slag Deposits and Flue Dust in the Subhearths of Openhearth Furnaces.** E. Neumann and J. Seitz. *Radex-Rundschau,* no. 8, 1956, p. 377-383.

Determination of quantities of slag deposits and flue dusts in furnaces with varied linings and firings, characteristic scale formation, and chemical analysis at different locations. (D2d; RM-q)

78-D. (German.) **Quality of Oxygen Steels (Sk or LD).** H. von Laizner. *Radex-Rundschau,* no. 8, 1956, p. 384-397.

Development of quality control schedules at the steel plant at Donawitz and application of new processes. (D10, S12)

79-D. Experimental Electric Smelting of Ores and Related Materials at the Department of Mines and Technical Surveys, Ottawa. G. E. Viens, R. A. Campbell and R. R. Rogers. *Canadian Mining and Metallurgical Bulletin,* v. 50, Feb. 1957, p. 70-77.

A three-phase, continuously-operated 250 kva. electric smelting furnace was installed at the Mines Branch for determining suitable smelting technique and costs of power and electrodes. Results of experiments show the value of electric smelting of iron, manganese-iron, titanium-iron, nickel and chromium-iron ores. (D8n, 1-2; Fe, Mn, Ti, Cr)

80-D. The "KALDO" Steelmaking Process in Operation. D. J. O. Brandt. *Iron and Coal Trades Review,* v. 174, Feb. 8, 1957, p. 325-327.

The new revolving kiln type of oxygen-conversion process which came into operation at Domnarfvet Steelworks, Sweden. Control of reactions and future development of the process. (D10; ST)

81-D. Use and Misuse of Ingot Moulds; Effect of Design on Corner Segregation. *Iron and Coal Trades Review,* v. 174, Feb. 8, 1957, p. 338-340.

Factors in the design of ingot molds, including some special designs, materials and the composition of metal to be cast, the use of the mold in the casting pit and some types of failure. (D9k, 1-2, 17-1)

82-D. Maintaining the Open Hearth. *Steel,* v. 140, March 4, 1957, p. 102-112.

Information on maintenance, inspection and repair of breakouts, bottom damage, the tap and flush holes, roof and other superstructures of openhearth furnaces. (D2, W18, 18-21)

83-D. (German.) **Continuously Cast Products for the Rolling Mill and the Forge.** Joseph Hofmaier. *Stahl und Eisen,* v. 77, Jan. 24, 1957, p. 69-78.

A description of continuous casting plants and their efficiency. Nature of the continuously cast billet and deformation work required in processing. Continuously cast slabs for the sheet rolling mill. Billets for the swage forge and for production of steel bars. 7 ref. (D9q; ST, 4-2)

84-D. (Book.) **A New Look at the Nature of the Open-Hearth Process.** B. M. Larsen. 1957. American Institute of Mining, Metallurgical and Petroleum Engineers, 29 W. 39th St., New York 13, N.Y. $3.00.

Unified analysis of the openhearth process in relation to the factors that control speed and fuel efficiency. Rate of heat flow in the bath, rate of carbon oxidation, and net heat requirement from fuel in relation to the amount of "air oxidation" from preheated or leakage air are treated quantitatively. Mechanism of downward heat flow and of carbon oxidation in the bath indicates the probable effect of excess oxygen, available immediately above the bath surface, on increased absorption of oxygen from the gas phase. (D2)

85-D. (Book—English.) **Production Cost of Plain Carbon Steel.** (Reprint from *Metallurgia Italiana,* v. 48, May 1956.) Petronio Allarme et al. 110 p. 1956. Associazione Italiana de Metallurgia, Via Moscova 16, Milano, Italy.

Technical and economic study of production costs and comparison between the openhearth and electric furnace processes. (D2, D5, 17-3; CN)

E Foundry

79-E. How an Investment Casting Solved a Modern Foundry's Problem. *Canadian Machinery and Manufacturing News,* v. 68, Jan. 1957, p. 84-87.

Seal housing and pouring operation in investment casting. (E15)

80-E. Crucible Melting—Review of the Present Stage of Development. D. W. Brown. *Foundry Trade Journal,* v. 102, Jan. 1957, p. 97-103.

Classification, design and use of crucible furnaces available. Melt quality, metal and crucible reactions and metal losses discussed. (E10p, 1-2)

81-E. Design of Diecastings and Diecasting Dies. Part III. W. M. Halliday. *Machinery Lloyd,* v. 29, Jan. 1957, p. 70-77.

Cored holes in the casting: design requirements, full-through and blind holes, minimum size of cored holes. (E13, 17-1)

82-E. Review of Shell Moulding and CO_2 Processes. J. L. Rice. *Metalworking Production,* v. 101, Jan. 4, 1957, p. 3-9.

Equipment needed, expense for materials, molding practices, dimensional control, advantages and shortcomings of shell molding and of CO_2 molding and core blowing processes. 21 ref. (E19c, E21)

83-E. Plastic Speeds Patternmaking. *Steel,* v. 140, Feb. 11, 1957, p. 108-109.

Epoxy resins simplify pattern changes, make patterns that are easily drawn and are useful in repair of pattern and core boxes. (E17; NM-d)

84-E. Ceramic Investment Shells Give High-Quality Castings. Nicholas J. Grant and Philip Manganaro. *Tool Engineer,* v. 38, Feb. 1957, p. 109-112.

New casting method for ferrous and nonferrous metals using lightweight ceramic shell molds. (E16c)

85-E. Core Making: the Neglected Back Room. O. A. Scott. *Canadian Metals,* v. 20, Feb. 1957, p. 46-48.

Eliminating core room inefficiencies; relative merits and disadvantages of CO_2 process cores. (To be continued.) (E21)

86-E. Grain Refinement of Aluminum 6% Tin. G. L. Foubert and W. C. Winegard. *Canadian Metals,* v. 20, Feb. 1957, p. 50-52.

Solidification characteristics of base alloy cast into molds at various temperatures. Addition of 1/10% titanium or a smaller portion of a mixture of titanium, zirconium and boron produced mark grain refinement. 10 ref. (E25q, 2-10; Al, *Sn*)

87-E. Pressure Diecastings of Steel. P. N. Bidula, I. I. Bobrov and K. N. Smirnova. *Engineers Digest,* v. 18, Jan. 1957, p. 23-24. Translation from *Liteinoe Proizvodstvo,* No. 7, July 1956, p. 1-4, 15.

Design of die-casting molds; mechanical properties of cast components for a range of carbon steels and comparison with those of the same type of steel in rolled form. (E13; CN)

88-E. Deoxidizing With Titanium Eliminates Pin Holes. R. D. Ahles. *Foundry,* v. 85, Mar. 1957, p. 112. (CMA)

The presence of gas holes in sand castings of Cr-Mo and Cr-Mo-V steel may be eliminated by adding elements which have an affinity for oxygen. Most lower the mechanical properties but titanium does not, nor is casting quality affected by residual titanium between 0.01 to 0.03%. Low sulphur levels are necessary. Normal heat treatment for the alloys described is 1922° F. for 12 hr. and an air quench. (E25s; AY, 5-10, *Ti*)

89-E. Investment "X" Process Makes Larger Investment Castings Possible. J. S. Turnbull. *Foundry,* v. 85, Mar. 1957, p. 117-119.

The investment "X" process is one of the techniques of producing castings by the lost-wax method. It is characterized by one-piece shell molds made by spray-coating or dip-coating a wax pattern with a permeable refractory slurry. (E15)

90-E. Production Factors Contributing to High-Quality Grey Iron. Dr. A. W. Schneble. *Foundry Trade Journal,* v. 102, Jan. 31, 1957, p. 131-134.

Layout and operations of American jobbing foundry practicing rigid quality control for molding, melting and pouring. (E11, 18-17; CI-n)

91-E. New Core Binder Showing Good Results in Aluminum Casting. *Light Metal Age,* Feb. 1957, p. 14-15.

Excellent collapsibility was obtained with the dextrose binder with no sacrifice of good green strength characteristics; component of core sand mixture is given. (E18)

92-E. Repairing Aluminum Castings With Metallic Resin Putty. Robert E. Williams. *Magazine of Applied Engineering,* v. 3, Feb. 1957, p. 116-119.

Epoxy putty is used in the foundry to repair defective castings, modify patterns and cement gates. (E26; Al, NM-d)

93-E. Now You Can Cast With Glass. *Plant Administration,* v. 17, Jan. 1957, p. 54-56.

Lost wax method uses a glass compound as the mold material, resulting in faster production, better finishes and lower costs. (E15, 1-2; NM-f42)

94-E. Door Opens to 75 Pound Aluminum Die Castings. Alfred F. Bauer. *SAE Journal,* Jan. 1957, p. 20-26.

Description of a 43-lb., 6-cylinder engine block as a one-piece die casting. The basic improvements: (1) all holes are cored, (2) relocation of camshaft to top of cylinder head and (3) drop pockets in both sides of the block (metal savers). (E13, T21b; Al)

95-E. (French.) **Studies on Shrinkage and Tolerances in Casting Under Pressure.** Tomonobu Kanno and Torazo Uehara. *Fonderie,* no. 132, Jan. 1957, p. 1-14.

Analyzes nature of shrinkage; gives a formula governing shrinkage in terms of expansion coefficient and temperature of the chill-mold, expansion coefficient of the metal cast, temperature of the casting at the beginning of shrinkage and ambient temperature; compares measured shrinkage with shrinkage calculated theoretically; notes relationship between tolerances and conditions of casting. (E25n, P10c)

96-E. (French.) **Report of a Mission to the United States Concerning the Manufacture of Malleable Cast Iron.** Jean Ménat. *Fonderie,* no. 132, Jan. 1957, p. 24-28.

Materials used, types of furnaces employed, quality control and various methods of production. Some 25 foundries in addition to several universities and research establishments were visited in February and March 1956. (E general; CI-s)

97-E. (French.) **Study of the Factors Affecting the Machining of Cast Iron Used in Heating Equipment.** Claude Riotte. *Fonderie,* no. 132, Jan. 1957, p. 29-33.

Improved method of casting, working and finishing gas burners by changing the composition of the metal (for example, by lowering the phosphorous content) and by modifying the operation of the cupola furnace permitting greater ease in machinability. (E10a, E11; CI)

98-E. (French.) **Developments in Precision Casting by the Lost-Wax Process.** *Revue Générale de Mécanique,* no. 95 (new series), Dec. 1956, p. 434-436.

Investment casting; production of patterns; casting variations; methods of production; economic factors involved. (E15)

99-E. (German.) **Treatment of Melts With Mechanical Vibrations.** P. Wincierz. *VDI Zeitschrift,* v. 98, Dec. 1, 1956, p. 1881-1882.

Degassing of melts by means of mechanical vibrations which are obtained by electromagnetic oscillation. (E25s, 1-2)

100-E. Try Shell Molds for Low Volume Casting. Samuel Freedman. *Iron Age,* v. 179, Feb. 28, 1957, p. 84-85.

Shell mold casting of aluminum waveguides proved to be economically feasible for small lot production. (E16c; Al)

101-E. Sealing Porosity in Metal Castings. Marvin Schneider and Henry Siesel. *Steel,* v. 140, March 4, 1957, p. 120-125.

Sequence of operations in sealing microporosity of aluminum and magnesium sand castings by vacuum impregnation. Advantages and disadvantages of sodium silicate and polyester resins used as sealing impregnants. (E25q; NM-d35)

102-E (French.) **Considerations on a Cupola Furnace Working in a Variable Atmosphere.** Wilhelm Heinrichs. *Fonderie Belge,* no. 1, Jan. 1957, p. 1-6.

Mode of operation of cupola furnaces in general; outlines maintenance problems, nature of the slag, charge and coke employed and the possibilities of varying the composition of the metal produced in furnace currently used by Krupps at Essen, Germany. (E10a, 1-2)

103-E. (Book—German.) **Precision Investment Casting Process.** Hans Allendorf. 324 p. 1956. Fachbuchverlag, Leipzig, Germany.

A survey of world-wide literature from 1943 to 1954. Topics include construction of lost wax models, casting molds, preparation of the mold for casting, dry sand molds, cleaning of the casting, gating practice, alloys for investment casting. Extensive patent and literature bibliography. (E15)

F Primary Mechanical Working

63-F. Production of Stepped Aluminum Alloy Extrusions in the United States. *Engineer,* v. 203, Jan. 18, 1957, p. 114-115.

Equipment, finishing, properties and applications. (F24, 1-2; Al)

64-F. Non-Slip Point in Rolling. Z. Wusatowski. *Iron and Steel,* v. 30, Feb. 1957, p. 53-59.

The choice of correct equations for calculating the position of non-slip point in hot and cold rolling. The basic equations for the position of the angle of nonslip point have been obtained. 10 ref. (F23)

65-F. Stepped Aluminum Extrusions. C. J. Huffman. *Machine and Tool Blue Book,* Feb. 1957, p. 119-127.

Process, tolerances, finishing operations, machining, future uses. (F24; Al)

66-F. Carbide Cuts Extrusion Costs. *Steel,* v. 140, Feb. 25, 1957, p. 112-113.

Chromium carbide dies used for making extruded brass rods outlasted steel five times and are easier to clean. (F24, 1-2; Cu, Cr, 6-19)

67-F. (French.) **Drawing of Steel Wire With Glass as a Lubricant.** Georges Leclerc. *Revue Générale de Mécanique,* no. 95 (new series), Dec. 1956, p. 423-428.

Advantages of using extrusion presses rather than rolling mills in the drawing of steel wire; production of extrusion presses and their application in various industrial fields. (F28, F24; ST, NM-h)

68-F. The Effects of Lubricants on the Surface Appearance of Aluminum After Plastic Deformation. L. H. Butler. *Metallurgia,* v. 55, Feb. 1957, p. 63-66.

Effects of surface deterioration under various conditions on lubrication and results of tests of variation of viscosity of lubricants containing no additives on the surface condition of aluminum in compression. (F general, G general; NM-h, Al)

69-F. Fuel Conservation in the Steel Industry. R. F. Perkins. *Research: Science and Its Application in Industry,* v. 10, Feb. 1957, p. 42-47.

Conservation in the steel industry, particularly with reference to casting bay and soaking pit practice. The courses of fuel losses are discussed, and details obtained in surveys of pit practice, and measurements made on 8 and 15-ton ingots are given. (F21b, D9, A11; RM-j, RM-k, RM-m)

G Secondary Mechanical Working

Forming and Machining

69-G. Production Contour-Etching. *Aircraft Production,* v. 19, Jan. 1957, p. 28-40.

Etching reagents, resistant coatings and etching technique. Contour etching permits rapid removal of metal, and its introduction into the aircraft industry resulted from difficulties encountered in forming sheet metal to the required contour after machining. (G24b)

70-G. Contour Etching. A. W. Sheppard. *Engineer,* v. 203, Jan. 18, 1957, p. 98-99.

Chemical reactions, comparative time and the weight factors of etching. (G24b)

71-G. Oxygen Cutting Titanium and Titanium Alloys. G. Coates. *Engineer,* v. 203, Jan. 25, 1957, p. 132-134. (CMA)

Successful tests of the oxygen cutting of titanium described. Transformation hardening and oxygen affinity are problems involved. Cost analysis shows that the method, based on raising the surface to the melting point in an oxidizing stream, is no more expensive than sawing and has advantages with intermediate sections. Uses include cropping of billets, trimming crude sections, preparing sections for welding and scrap cutting. (G22; Ti)

72-G. Stamping: What Type Dies to Use. Federico Strasser. *Iron Age,* v. 179, Feb. 7, 1957, p. 99-101.

Advantages of separate compound or progressive dies for different stamping jobs. (G3, 1-2)

73-G. Contour Etching. A. W. Sheppard. *Machinery,* v. 90, Jan. 18, 1957, p. 153-159.

Chemical etching or milling has been applied to magnesium, titanium, copper, aluminum and steels, but with greatest success to aluminum alloys. Etching process consisting of precleaning, masking with a resistant coating, etching and neutralizing has been valuable in applications requiring intricate construction with different gage sheet. Fatigue test results are similar for machine and contour etched specimens. (G24b; Mg, Al, Ti, ST)

74-G. Machining Operations on Intricate Frame Components. *Machinery,* v. 90, Feb. 1, 1957, p. 255-258.

Principal machining operations on two airframe components, which are performed with the aid of adapted equipment at the works of General Engineering, Inc. U.S.A. One of the components forms part of the structure and lower inboard wing surface of an experimental fighter-bomber, and the other is a main wing spar beam for a light bomber. Both parts are machined from solid billets so that heavy metal removal is involved. (G17; T24)

75-G. Sawing Radio-Active Metals by the Arc-Process. Frank Bevilacqua. *Metalworking Production,* v. 101, Jan. 4, 1957, p. 11-13.

Plastic enclosed unit using rotating disk with electrical discharge through dielectric solution satisfactorily cuts variety of radioactive metals. (G24d)

76-G. Grinding Jet Blades by Abrasive Belt Method. Bartlett West. *Modern Machine Shop,* v. 29, Feb. 1957, p. 118-121.

Battery of platen-type abrasive belt grinders, coupled with simple but unique fixtures, provides for rapid stock removal in jet blade production. (G18k, 1-2)

77-G. A New Method of Electro-Machining of Hard Metals. Tasaburo Yamaguti. *Proceedings of Japan Academy,* v. 32, Oct. 1956, p. 579-584.

Experimental apparatus and circuits described, results given. (G24d, 1-2)

78-G. Some Studies of Angle Relationships in Metal Cutting. J. H. Creveling, T. F. Jordan and E. G. Thomsen. *Transactions of the ASME,* v. 79, Jan. 1957, p. 127-138.

Free-cutting steel, SAE 1113, in the annealed state, and SAE 1113 and SAE 4135 in the cold rolled condition, studied in orthogonal metal cutting. Theory, experimental procedure, results. 17 ref. (G17; CN, AY, SGA-k)

79-G. Influence of Grinding Fluids Upon Residual Stress in Hardened Steel. H. R. Letner. *Transactions of the ASME,* v. 79, Jan. 1957, p. 149-153.

Stresses were analyzed in bars of hardened ball-bearing steel, surface ground in the presence of 13 different fluids. Results suggest that the effectiveness of a fluid in minimizing residual grinding stresses depends upon its ability to reduce frictional forces between the wheel and the work. 8 ref. (G18, Q25h; ST, NM-h)

80-G. (Japanese.) **Deep Drawing of Rectangular Vessel.** Nobuji Fukni, Seita Yoshida, Kumio Abe and Yujuo Horita. *Nippon Kikai Gakaishi,* v. 59, Dec. 1956, p. 898-903.

Limit of deep drawing and maximum deep drawing force. Experimental results on test pieces such as aluminum, copper and brass. (G4b; Al, Cu)

81-G. (Japanese.) **Mechanical Working by Supersonics.** Gentaro Nishinaura. *Nippon Kikai Gakaishi,* v. 59, Dec. 1956, p. 904-915.

Free vibration of exponential horn, compulsory vibration of exponential horn, and mechanism of throwing action. 12 ref. (G24c)

82-G. Contour-Etching. A. W. Sheppard. *Aircraft Production,* v. 19, Feb. 1957, p. 71.

Process of removing metal by controlled chemical action; taper contour-etching; physical and mechanical effects of contour etching. (G24b)

83-G. Consider All Variables, and Superalloys Will Not Hurt Production Rates. M. L. Schuehle and H. L. Bartow. *American Machinist,* v. 101, Feb. 25, 1957, p. 145-148. (CMA)

Developments in working titanium are considered. It has been shown that existing tools and methods are applicable to fabricating airframes from Ti-6Al-4V. Results are given for rough and finish profile milling of titanium alloys and stainless steels. (G17b; Ti, SS)

84-G. Ultrafinishing—a New High-Precision Lapping Process. T. G. Lewis. *American Society of Mechanical Engineers,* Preprint no. 56-A-77, Nov. 1956, 8 p.

A number of important innovations have been made which permit the use of lapping for the production of exceptionally smooth metal surfaces with precise geometrical control. The body of patented techniques, called ultrafinishing, includes the necessary variations in velocity to permit the lapping of soft homogeneous and hard heterogeneous metals. (G19p)

85-G. Transient Interface Temperatures in Plain Peripheral Milling. D. E. Mcferon and B. T. Chao. *American Society of Mechanical Engineers,* Preprint 56-A-89, Nov. 1956, 9 p.

The analytical calculation of tool-chip interface temperature has been extended to the plain peripheral milling process. The solution of the equations presented enables an investigation of the effects of material and process variables to be made from cutting data. 22 ref. (G17, Q2g)

86-G. Shear-Strain Rate in Metal Cutting and Its Effects on Shear Flow Stress. D. Kececioglu. *American Society of Mechanical Engineers,* Preprint 56-A-154, Nov. 1956, 24 p.

A relationship is derived from the average shear-strain rate in the shear zone, during orthogonal or oblique cutting, which may be calculated if the average shear-zone thickness is described. This involves the use of a mechanism that stops the cutting process practically instantaneously and thus "freezes" the process of chip formation. (G17, Q2g)

87-G. Ceramic and Carbide Tool Performance Tests—Part I. A. U. Schmit, I. Ham and G. E. Wilson. *American Society of Mechanical Engineers,* Preprint 56-A-218, Nov. 1956, 15 p.

The report summarizes findings of a series of comparative laboratory and shop tests with ceramic and carbide tools; consideration of the design, mounting and grinding of tools, increased rigidity, adequate speed and feed ranges and sufficient power must be provided in machine tools to utilize the full potential of ceramics. (G17, T6; 6-19, 6-20)

88-G. Abrasive Cutter Sails Through Tough Super-Alloys. Curtis Cummings. *Iron Age,* v. 179, Feb. 21, 1957, p. 96-98.

Tough alloys such as Hastelloy are cut at rates of 4 to 6 sq. in. per min. with an accuracy of plus or minus 1/32 in. by abrasive cut-off machines. (G17, 1-2; Co)

89-G. A New Method of Cold Extrusion. Mahito Kunogi. *Japanese Scientific Research Institute, Journal,* v. 50, Dec. 1956, p. 215-246.

A new method developed as a consequence of analysis of plastic flow in the cold extrusion process for steel. In the new process, the extrusion pressure is reduced about 40% compared with the usual one, this method can be applied to the cold forming process of a wide variety of steels such as nitriding steel, special toolsteel, bearing steel, and austenitic stainless steel. (G5; AY, TS, SS)

90-G. Magnesium Forming. R. G. Wilkinson. *Metal Industry,* v. 90, Feb. 1957, p. 83-86.

Some of the problems involved in the hot forming and joining of magnesium alloys in aircraft production. (G general, K general; Mg)

91-G. Drawing of Titanium. J. S. Kirkpatrick. *Metal Progress,* v. 71, Feb. 1957, p. 148-150. (From American Society of Tool Engineers, Collected Papers 24T2.) (CMA)

History, crystal structure and available fabricated forms; use in military aircraft. Alloys are more difficult to form than metal. Heating the dies, stress-relief and lubrication of the die are discussed. (G4; Ti)

92-G. Researches on the Lapping of Metals. II. On Velocity and Lapping Method. Hideo Tsurva. *Osaka University, Technology Reports,* v. 5, Oct. 1955, p. 411-417.

Results of experiments on the working velocity and on the lapping fluid that have effects on the mechanism of cutting. Lapping removal varies with the kind of lapping fluid. Petroleum and rape oil give the best performance. (G19p, NM-h)

93-G. Titanium Chips Can Be Broken Easily. J. L. Wennberg. *Tool Engineer,* v. 38, Mar. 1957, p. 91-94. (CMA)

Study of the chip-breaking characteristics of titanium in machining operations shows that titanium chips can be controlled. The chip-breaking feed and chip thickness increase as the speed decreases, and the chips are more work hardened and more difficult to break. The prevailing chip type is an intermittent connected series of 3 to 10 "9"s. Graphs are shown which indicate the best position for a chip breaker. (G17; Ti)

94-G. Roll Planishing Gives Improved Joint Efficiency. H. L. Meredith and B. R. Russell. *Welding Engineer,* v. 42, Feb. 1957, p. 68-72.

Roll planishing of sheet metal welds increased tensile yield and fatigue strengths and slightly decreased elongation. Relationships between weld dimensions and planishing process. (G23s; 7-1)

95-G. Ultrasonic Impact Grinding Produces Precise Shaped Holes, Slots on Servo-Valves With Ease. A. E. Shumate. *Western Metals,* v. 15, Feb. 1957, p. 41-43.

Abrasive particles set in motion by tool vibrating at rate of 25,000 cm. per sec. precision cuts small holes or slots in variety of hard metals. (G24c)

96-G. Electrical Discharge Method Machines Complex Forms on Convair's Carbide Tools. R. S. Watt. *Western Metals,* v. 15, Feb. 1957, p. 52-53.

Finishes and cutting edges of carbide tipped turning and facing tools obtained by electrical discharge were superior to those obtained by diamond wheel grinding. Pantograph attachment eliminated master tool and allowed direct reproduction of each form. (G24a)

97-G. The Machining Properties of Non-Ferrous Metals. D. F. Galloway. Paper from "Final Forming and Shaping of Non-Ferrous Metals". Institute of Metals, 1956, p. 5-15.

Apparatus for measurement of cutting forces and tool shape, considerations influencing the design of experiments. The diversity of the machining properties of nonferrous alloys is exemplified by comparisons of cutting forces for a range of nonferrous and ferrous alloys. (G17, 1-3, A9p; EG-a38)

98-G. The Deep Drawing and Spinning of Sheet Metal, With Particular Reference to Non-Ferrous Materials. John A. Grainger. Paper from "Final Forming and Shaping of Non-Ferrous Metals". Institute of Metals, 1956, p. 17-30.

Recent developments in machines and methods for the deep drawing and spinning of sheet are reviewed. Particular attention is devoted to techniques, such as marforming, hydroforming, and flowturning, which provide an inexpensive means of producing small quantities of parts, and to their application to nonferrous metals. Lubrication is also discussed. (G4b, G13, G14b; EG-a38, 4-3)

99-G. Rubber Pressing. J. Fielding. Paper from "Final Forming and Shaping of Non-Ferrous Metals". Institute of Metals, 1956, p. 31-43.

Reasons why rubber pressing is used for the forming of aircraft components. Methods and equipment for forming aluminum and magnesium alloys and titanium. Deformations possible with straight and curved flanges and the effects of heat treatment, flange design and sheet thickness outlined to provide information for the designer. The merits of "cold" and "hot" forming of magnesium alloys and titanium are discussed, and details of the hot pressing techniques are given with special reference to die materials, temperatures, pressures and heat resisting rubber. 10 ref. (G14a, 1-2; Al, Mg, Ti)

100-G. Research Into Some Metal-Forming and Shaping Operations. W. Johnson. Paper from "Final Forming and Shaping of Non-Ferrous Metals". Institute of Metals, 1956, p. 45-59.

Experimental and theoretical investigations of the drawing of cylindrical shells with hemispherical and flat-headed punches, with particular reference to the effects of lubrication, drawing speed and flange wrinkling; coining; ironing; tube-sinking; impact extrusion under a drop hammer; detection and measurement of residual stress in cold drawn tubes. (G4, G3, G5, Q25h)

101-G. Cold Roll-Forming and Manipulation of Light-Gauge Sections. E. Griffin. Paper from "Final Forming and Shaping of Non-Ferrous Metals". Institute of Metals, 1956, p. 61-77.

Advantages of cold forming as a method for producing sections of complicated profile from strip in large quantity. The forming process described in detail, with accounts of the types of machine used and their capacities, calculation of power requirements, and the design and manufacture of roll-forming tools. (G11, 1-17, 1-2)

102-G. Stretch-Forming of Non-Ferrous Metals. R. D. Edwards. Paper from "Final Forming and Shaping of Non-Ferrous Metals". Institute of Metals, 1956, p. 79-89.

After a brief account of the theory of stretch-forming, machines and methods are described for stretch-forming aluminum alloy sheets, extrusions, and sections for use mainly in the aircraft industry. Aspects dealt with include the limitations of the method, effects of heat treatment and differential work hardening, type of stretch-forming and stretch-wrapping machines, and the design of, and materials for tools. (G9, 1-2; EG-a38)

103-G. Bending and Allied Forming Operations. T. G. Perry. Paper from "Final Forming and Shaping of Non-Ferrous Metals". Institute of Metals, 1956, p. 91-96.

Metallurgical factors involved in plain bending, tube bending, flanging and rolling. Concept of the strain-hardening exponent is used to provide empirical relationships for rolling machine capacities, and for buckling criteria in bending. (G6, Q5g)

104-G. The Hot Forming of Magnesium Alloys. R. G. Wilkinson. Paper from "Final Forming and Shaping of Non-Ferrous Metals". Institute of Metals, 1956, p. 97-108.

Magnesium-base alloys, having a close-packed hexagonal crystal lattice, are capable of only limited cold deformation, and so, unless the work is very simple, they are usually formed at elevated temperature. This practice involves obvious operational disadvantages, but possesses important compensating features. After detailing the compositions and mechanical properties of the principal wrought alloys and giving data on the effects of heating on the properties, the special requirements in equipment and procedures for hot forming sheet and extrusions are reviewed. (G general, 1-16, 1-2; Mg)

105-G. (German.) **A New System of Straightening.** Manfred Müller. *Draht,* v. 8, Jan. 1957, p. 1-3.

Description of a thread-rolling machine with rotating roll for straightening cylindrical parts such as valves, heat treated set screws, etc. (G12, 1-2)

106-G. (Russian.) **Heat Balance Sheet of Cutting Titanium Alloy VT2.** A. M. Danielyan. *Vestnik Mashinostroeniya,* v. 37, Jan. 1957, p. 39-43. (CMA)

The total amount of heat developed during cutting of titanium alloy TV2 (Russian designation) was measured dynamometrically (i.e., as an equivalent of the mechanical work absorbed), and the distribution of that heat among the chips, the workpiece and the cutting tool was determined calorimetrically. Parallel measurements on steel 45 (Russian designation) served for comparisons. It was found that the general trend of the dependence of the above characteristics on the cutting speed is the same in both alloy and steel; however, the absolute values differ considerably. Thus, the cutting temperatures are generally higher for alloy VT2 than for steel 45 by 300 to 450° C.; the tool's share in the generated heat is 3 to 4 times as large in cutting the alloy than it is in cutting the steel, the difference being due to the low thermal conductivity of the titanium alloy. Eleven graphs show the changes of temperatures and heats in the chip, work and tool with increasing speed (up to 60 m. per min.). 1 ref. (G17, P11k; Ti)

107-G. Magnesium Is Drawn and Ribbed. George H. DeGroat. *American Machinist,* v. 101, Feb. 25, 1957, p. 140-141.

Draw of 8 in. in 0.091-in. sheet producing rectangular box-shape part is made with a single stroke by 200-ton hydraulic press. Tools and blank are heated to 600° F., before drawing. (G4d; Mg)

108-G. The Use of Grinding Wheels and Abrasives in Relation to Welding. W. L. Campbell-Pitt. *Engineer and Foundryman,* v. 21, Jan. 1957, p. 51-57.

Contribution of abrasives such as corundum, silicon carbide, aluminum oxide and diamonds to welding. Grinding techniques. (G18, K general; NM-j)

109-G. Grinding Aluminum. *Grinding and Finishing,* v. 2, Feb. 1957, p. 28-32.

Aluminum grinding problems: wheel loading, undue heat and inferior surface finishes. A review of fundamentals is given. (G18; Al)

110-G. How Much do Grinding Fluids Affect Wheel Performance. Part I. J. A. Mueller. *Iron Age,* v. 179, Feb. 28, 1957, p. 79-81.

Experiments evaluating effect on amount of metal removed, wheel wear, power consumed, finish obtained and cutting rate for grinding fluids—including oils, water emulsions and gases. (To be concluded.) (G18; NM-h)

111-G. Draw, Polish Bar in One Machine. J. H. Glose. *Iron Age,* v. 179, Feb. 28, 1957, p. 88-89.

Automatic machine cold draws, cuts off, straightens and polishes steel bars of 3/16 to ½ in. from coiled rods. (G4, L10b, 1-2; ST, 4-5)

112-G. Cold Extrusion and Deep Drawing. O. May. *Machinery,* v. 90, Feb. 22, 1957, p. 425-428.

Choice of cold extrusion or drawing for the production of cups from blanks was influenced by the amount of waste material resulting from each process; cold extrusion reduced wastage to about 10%. Merits of slug production and details of extrusion and deep-drawing presses. (G4b, G5; ST)

113-G. Rolling "Hats" From Tapered Strip. C. H. Beattie. *Machinery,* v. 63, March 1957, p. 157-158.

Aluminum tapered strip 30 ft. long was cold rolled to a perfect hat-shaped section. Thickness varied from 0.035 in. to 0.070 in. Forming difficulties overcome by use of a split male die. Description of operation. (G11, 1-16; Al)

114-G. How Are Your Carbide Tools Performing? Part 2. *Machinery,* v. 63, March 1957, p. 196-202.

Effects of shape, speed, feed, depth of cut and influence of cutting fluid on cutting forces and tool life is presented, documented by extensive test results. (G17, T6; 6-19)

115-G. Contour Etching. A. W. Sheppard. *Metal Industry,* v. 90, Jan. 18, 1957, p. 48-50.

Process of chemical milling or contour etching, by hot alkaline solution, of aluminum alloys for forming sheet to required contours dictated by design requirements. Process consist of pretreatment cleaning, application of resistance medium (known as masking), etching and post-treatment neutralizing and cleaning. Time and weight factors discussed. (G24b)

116-G. Distribution of Temperature in a Cylindrical Grinding Machine, From Starting to Steady State. G. Pablitzsch. *Microtecnic,* v. 10, no. 5, p. 215-218.

Tests showed that the running-in duration of 30 min., often specified, is far from being sufficient to bring a grinding machine to a steady state as far as temperature is concerned. Bearing play of the grinding spindle has almost permanent value after 30 min. running of the grinding machine. (G18g, P11)

117-G. Make Complex Shapes in Continuous Strips. *Steel,* v. 140, March 4, 1957, p. 95-98.

Cold roll forming, its definition, advantages, standard equipment used, roll design, materials for rolls and auxiliary equipment. A few present uses and future possibilities. (G11, 1-17, 1-2)

118-G. (French.) **Roller Shaping of Parts Previous to Subjection to High Temperatures.** Frank J. Altman. *Machine Moderne et Revue Mecanique,* no. 575, Feb. 1957, p. 1-7.

Extensive use of stainless steel and titanium alloys in the manufacture of aircraft parts has led to an economical method of shaping the metal. A special roller is employed equipped with a cylinder of wide diameter, with variable pressure regulation, mounted upon a table with reciprocating motion. A die furnishing the necessary imprint is mounted on the table and the cylinder forces the metal, previously heated, into the cast. (G11, 1-2; SS, Ti)

119-G. (Italian.) **Action of Lubri-Coolant Liquids in Machining of Metals by Chip Removal.** Arnaldo Recine. *Ingegneria Meccanica,* v. 5, May 1956, p. 35-40.

Discussion of lubricants and so-called co-lubricants (air, metallic oxides, self-forming metallic "soaps", and skins); limitations of liquid lubricants. (G17; NM-h)

120-G. (Italian.) **Examples of Technical Mistakes.** Edmondo Marianeschi. *Ingegneria Meccanica,* v. 5, May 1956, p. 49-50.

Inadequate preheating of Cr-Mo steel part before machining causes cracking of surface and rejection of piece. Inexpert grinding of shear blade results in intense surface heat and spoiling of blade. Internal cracking of large block of Ni-Cr steel caused by uneven heating; ultrasonic device detects flaws and pieces not machined. (G17, G18, S13g9)

121-G. Technical Manual on the Machining of Thermenol. Duraley Co. (U.S. Bureau of Aeronautics) *U.S. Office of Technical Services,* PB 121660, Feb. 1956, 22 p. $.75.

The machining of Thermenol, a new aluminum-molybdenum-iron alloy; methods include parting, turning, boring, threading, shaping, drilling, tapping and milling. (G17, Al, Mo, Fe, SGA-h)

122-G. (Book.) **The Final Forming and Shaping of Wrought Non-Ferrous Metals.** 129 p. 1956. Institute of Metals, 17 Belgrave Square, London S.W., England. $3.50.

Machining properties, deep drawing, spinning, rubber pressing, metal forming and bending. The eight papers are abstracted separately. (G general; EG-a38)

H Powder Metallurgy

20-H. Producing Powdered Metal Components. Techniques of Importance to the Electrical Industry. K. Roney. *Electrical Times,* v. 131, Jan. 10, 1957, p. 41-44.

Manufacture and applications of metal powders; two of the most important processes in manufacture are considered to be annealing and sintering. (H general, T1)

21-H. Powder Metallurgy Provides a Short Cut to Titanium Parts. E. P. Weber. *Modern Metals,* v. 13, Feb. 1957, p. 48-49, 50, 52. (CMA)

Four important methods of making titanium powder described. The electrolytic approach is not yet commercial, while the hydriding method yields the finest powder; mechanical powdering is feasible only for coarse powder. Working the powder may be accomplished by hot pressing, best for large parts, or press forming, which may be combined with extrusion, rolling, swaging and drawing. Specimens have good tensile and fatigue properties. (H10, H14; Ti)

22-H. Design Limits Set by Tooling for Powder Metal Parts. George G. Karian. *Electrical Manufacturing,* Feb. 1957, p. 110-115.

Principles of powder metal design. Five classes of parts and tools discussed from design point of view. (H general, 17-1)

23-H. Powder Metallurgy. J. F. C. Morden. *Metal Industry,* v. 90, Feb. 8, 1957, p. 103-105, 108.

Furnaces, gas atmospheres for sintering. (H15q, W26)

J Heat Treatment

55-J. Integrated Setup Cleans and Stress Relieves Castings. W. G. Patton. *Iron Age,* v. 179, Feb. 7, 1957, p. 112-113.

Automatic transmission plant connects stress-relieving furnace by conveyer with a Kolene salt bath to ready castings for machining. (J1a, L12n; CI)

56-J. Kinetics of Nitridation of Magnesium and Aluminum. Prasom Sthapitanoda and John L. Margrave. *Journal of Physical Chemistry,* v. 60, Dec. 1956, p. 1628-1633.

Research on kinetics of nitriding as a function of time, temperature, pressure and surface penetration. A manometric apparatus was used for all of the measurements. (J28k, 1-4; Mg, Al)

57-J. Today's Quenching Needs. S. J. Barber. *Metal Treating,* v. 8, Jan.-Feb. 1957, p. 2-6; disc., p. 28-29.

Advantages, disadvantages, and effects of quenching media and list of common-sense quenching hints. (J26)

58-J. A Note on the Furnace Cracking of an Austenitic Stainless Steel. F. A. Hodierne. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 225-227.

Cold drawn tubes in an 18-10 austenitic stainless steel containing columbium cracked transversely on heating for interpass softening. This cracking was reproduced experimentally in a laboratory test at temperatures between 650 and 950° C., and appears to be associated with the precipitation of intergranular carbides in a steel with high internal stress. Cracking has been avoided in practice by precipitating the carbides at 850° C. before cold drawing the tubes. (J27, 9-22; SS-e)

59-J. Heat Treatment Restores Ductility to Forged Titanium Alloys. D. N. Williams and R. I. Jaffee. *Journal of Metals,* v. 9, Feb. 1957, p. 254-260. (CMA)

The high rejection rate of forged Ti-140A compressor wheels on the basis of inadequate ductility made their reclamation desirable. Heat treatment studies were conducted on wheels of Ti-140A and RC-130B. Annealing about 100° F. below β transus, cooling to the stabilization temperature and stabilizing is a beneficial treatment; α is dissolved until only nucleation sites remain. Higher ductilities were thus developed in Ti-140A than in RC-130B. 3 ref. (J23, Q23p; Ti, 4-1)

60-J. (English.) **On the Distortion of Ball Bearing Steel.** Akira Adachi and Zim-Ichro Morita. *Osaka University, Technology Reports,* v. 6, Mar. 1956, p. 133-139.

Using standard specimens the distortion of ball bearing steel was studied after various heat treatments. From the results of experiments, it was found that by good hardening operations the thermal strain could be eliminated, except the unavoidable transformation strain. 10 ref. (J general, Q25p, 9-24, T7d; ST)

61-J. Controlled Atmospheres for Heat Treatment. Akira Adachi and Shimtaro Yamada. *Osaka University, Technology Reports,* v. 5, Oct. 1955, p. 419-423.

The composition of generated gases from town gas, propane gas, gasoline and kerosene, and the effect of the atmosphere for heated steel. 5 ref. (J2k; NM-g)

62-J. (English.) Heat Treatment With Salt Baths in France. *Aciers Fins et Spéciaux Francais,* no. 24, Dec. 1956, p. 31-34.

Use of salt baths as a method of heating for hardening and tempering steels; isothermal treatments (bainitic hardening and isothermal tempering) and hardening by stages; case-hardening salts and tempering salts; salt bath furnaces. (J2j; ST)

63-J. (French.) Cementation Steels. J. Marcovi and P. Tordjman. *Métallurgie et la Construction Mécanique,* v. 89, Jan. 1957, p. 43-47.

Lists the principal grades of cementation steels, with their analysis, mechanical properties and a few particulars concerning their processing and errors to be avoided. Details on the processing of steel cover forging, annealing and normalizing, and cementation. (J28, J23, J24, ST)

64-J. (German.) The XII Heat-Treating Symposium, Oct. 18 and 19, 1956, Stuttgart, Germany, Oct. 23 and 24, 1956, Essen, Germany. A Summary of the Proceedings. *Draht,* v. 8, Jan. 1956, p. 13-17.

Automation and mechanization of heat treatment processes and equipment were principal subjects discussed. Individual lectures are abstracted. (J general, 18-24)

65-J. Carburize, Martemper Parts in Single-Line Setup. C. E. Kopp. *Iron Age,* v. 179, Feb. 28, 1957, p. 82-83.

Among the advantages of mechanized salt bath line for carburizing and martempering of outboard motor crankshafts are uniform carburization of all surfaces with assured penetration, close temperature control and minimized distortion. (J2j, J26p, J28g; ST)

66-J. Investigation of the Annealing of Deformed Nickel Powder by X-Ray and Stored Energy Measurements. D. Michell and F. D. Haig. *Philosophical Magazine,* v. 2, Series 8, Jan. 1957, p. 15-32.

The stored energy was measured by a calorimetric method. The measured value of 3.6 cal. per g. and the manner of its release suggests that a wide range of deformation is present. The diffraction patterns, measured with a Geiger counter spectrometer, show that during annealing there is no change in the background intensity. 16 ref. (J23, 1-4; Ni)

67-J. A Survey of the Types of Furnace Atmospheres. C. H. Vaughan. *Steel Processing and Conversion,* v. 43, Feb. 1957, p. 96-98; disc., p. 100-103.

Types of furnace atmosphere gases, principal components and effects. Six basic atmospheres are considered: exothermically produced combustion gas, endothermically produced combustion gas, nitrogen, dissociated ammonia, hydrogen and argon and helium. (J2k, B25; RM-g)

68-J. Structure and Hardness of Liquid Nitrided Cases. Howard E. Boyer. *Steel Processing and Conversion,* v. 43, Feb. 1957, p. 84; disc., p. 105-106.

Micrographs and depth hardness chart of three alloy steels after salt bath nitriding, namely, a high speed, AMS 6470, and a stainless steel. (J28k, M27, Q29n; TS-m, AY, SS)

69-J. (Italian.) Determination of Specifications of Induction Heat Treating Plants. Ciro di Piero. *Ingegneria Meccanica,* v. 5, March 1956, p. 5-15.

Review of basic principles of induction heat treating followed by presentation of factors permitting determination of power transformance into heat, erficiency of heat treating operation, time required for process, and power requirements, both for annealing and surface hardening. (J2g)

X Assembling and Joining

113-K. Welding Zirconium Requires Special Techniques. W. R. Gall. *American Machinist,* v. 100, Dec. 1956, p. 65-67.

Techniques employed in welding heavy zirconium plate and forgings for an atomic reactor vessel, using helium shielding. (K1d; Zr)

114-K. Stud Welding, Its Use in the Oil and Cnemical Industries. E. F. Robinson. *Machinery Lloyd,* v. 29, Jan. 1957, p. 89-92.

Types of studs, technique of applying studs, applications of stud welding. (K1f)

115-K. Fabrication of the Homogeneous Reactor Test Vessel Assembly. L. F. Bledsoe, et al. *American Society of Naval Engineers, Journal,* v. 69, Feb. 1957, p. 123-130. (CMA)

Inert-gas-shielded tungsten-arc welding process was employed in the fabrication of a Zircaloy-2 core vessel and pressure vessel. Unusual problems were involved because of design. (K1d, T11; Zr)

116-K. What Are Welding Stresses? H. J. Nichols. *Canadian Metals,* v. 20, Feb. 1957, p. 30-32.

Plastic flow, weld metal shrinkage, amount of restraint on welded part and other factors determine residual and reaction stresses; effects of stresses on welded structure. (K9n, Q25)

117-K. Some Problems of Aluminum Connection. C. T. Marx. *Electrical Energy,* v. 1, Dec. 1956, p. 109-112.

Methods and problems of connecting aluminum are discussed and attention is drawn to differences in practice between copper and aluminum joining. Soldering, bolting and crimping are discussed. (K7, K13; Al)

118-K. No-Mix Epoxy Joins Metals Fast. Bernard Gould. *Iron Age,* v. 179, Feb. 21, 1957, p. 94-95.

One part epoxy adhesive for metal to metal joining requires no mixing or curing additive, has long storage life, variable curing cycle, relatively high bond strength. (K12; NM-d)

119-K. Weld Quality Rides With Steel Selection. A. C. Ward. *Iron Age,* v. 179, Feb. 21, 1957, p. 104-106.

Manufacturing methods, analysis and properties for typical low, medium and high-carbon steels, hot rolled or cold worked, and their effect on welding procedures and electrode selection. (K general; CN)

120-K. Resistance Welding: Some Recent Developments. N. K. Gardner. *Mass Production,* v. 33, Feb. 1957, p. 63-67, 118.

Spot, seam and resistance welding at the design stages in aircraft industry. (To be continued.) (K3, T24, 17-1)

121-K. Adhesives in Metal Bonding. *Mechanical World and Engineering Record,* v. 137, Feb. 1957, p. 54-58.

Development of new theories of adhesion side by side with advances made in producing synthetic resin adhesives offers the engineer a new method of metal joining. The technique has been applied mainly to aircraft construction, and its chief merit is in decreasing the weight of the structure. (K12)

122-K. Metal Arc Welding of Mild Steel Plate. R. S. Bolton. *New Zealand Engineering,* v. 11, Dec. 15, 1956, p. 400-408.

Selection of plate for welded structure; cracking in welds, welding stresses and stress relief, welding defects, welding procedure; automatic welding. 21 ref. (K1, J1a, 9; CN)

123-K. Some Aspects of the Welding of Structural Steel. W. Burrows. *New Zealand Engineering,* v. 11, Dec. 15, 1956, p. 415-418.

Classification and coding of electrodes for metal arc welding of mild steels and medium high-tensile steel of structural quality according to British standards; alloying elements and refining of steels, manufacture of electrodes, electrode testing; welding procedure; examination and repairs of welds. (K general, W29; ST, SGB-s)

124-K. On the Welding Arc Atmosphere (Continued.) Iwao Ohmishi and Yoneo Kikuta. *Osaka University Technology Reports,* v. 6, Mar. 1956, p. 155-161.

Investigation of the partial pressure of hydrogen in arc atmosphere and the volume of hydrogen in deposit metal, using commercial electrodes manufactured and used for industrial purpose in Japan. (K1, W29)

125-K. Effect of the Tip Temperature on the Gas Ratio of Oxy-Acetylene Flame in the Low Pressure Type Welding Torch. Iwao Onishi and Masao Mizuno. *Osaka University Technology Reports,* v. 5, Oct. 1955, p. 453-467.

The temperature rise of torch under various conditions was measured with thermocouples at several positions of each torch, and the change of mixed gas ratio (oxygen-acetylene) which is caused by the temperature rise of tips was determined in accordance with the continuous measurement of gas pressure and its consumption. (K2h, 1-2)

126-K. New Way to Weld Aluminum. *Steel,* v. 140, Feb. 25, 1957, p. 108-111.

Alforge, a patented welding process, uses limited heat (350 to 500° F.) and high forging pressures to join aluminum or magnesium to give a high-strength weld. Parts are heated by flame. (K5h; Al)

127-K. Nickel-Alloy Pump Is Tig-Welded for AEC. E. Nutter. *Welding Engineer,* v. 42, Feb. 1957, p. 61-64.

Multiple pass technique with tungsten tip and argon shield was used for welding high-temperature nickel alloy centrifugal pump assemblies. Die penetration tests were made and finished parts were heat treated in a helium and hydrogen atmosphere. (K1d, W13, 17-7; Ni)

128-K. (French.) A New Clamp Joint for Tubular Bodies. *Revue de l'Aluminium,* no. 239, Jan. 1957, p. 81-82.

New method for clamp joining sheets, the main feature of which consists of trapezoidal tongs with

stoppers which interlock. The assembly is obtained by folding down the stoppers on a mandrel. This process provides a way of making hollow bodies with curved sheet, especially suited for the construction of towers and masts. (K13q; Al, 4-3)

129-K. Modern Welding. H. G. Taylor. *British Petroleum Equipment News,* v. 5, no. 5, Winter 56/57, p. 56-61.

Submerged arc, argon arc and inert arc welding discussed. (To be continued.) (K1)

130-K. A Review of Inert Arc Welding (Stainless Steel). W. E. McFee. *Industry and Welding,* v. 30, March 1957, p. 54-59.

Significant features and advantages of inert-gas shielded arc welding of stainless steels. (K1d; SS)

131-K. 300 Silver Brazed Joints Simplify Fabrication of Dissimilar Metals. *Industry and Welding,* v. 50, March 1957, p. 62-68.

Silver alloy braking of joints in large air separators manufactured by Air Products Inc., Allentown, Pa. Dissimilar metals brazed together include various combinations of Type-304 stainless steel, cast and forged bronze and copper, and Carboloy. (K8; SS, Cu, W, 6-19)

132-K. New Arc Welding Process Speeds Fabrication of Carbon Steels. *Industry and Welding,* v. 30, March 1957, p. 44-48, 69-70.

New manual, semi-automatic welding process producing high-quality welds in carbon steel has been introduced by Linde Air Products, under the name "Unionarc", employing a continuously fed wire electrode magnetically coated with flux and shielded in a CO_2 gas atmosphere. (K1a; CN)

133-K. Aircraft Industry Makes Most of Resistance Welding. *Industry and Welding,* v. 30, March 1957, p. 74-79.

Resistance welding makes possible high-quality, high-production structural assemblies for modern aircraft and has decided advantages over riveting techniques. (K3, T24)

134-K. Here's a "Plug" for CO_2 Welding. *Industry and Welding,* v. 30, March 1957, p. 80-81, 114.

Development of a more efficient plug welding technique by the Chicago Steel Tank Co. by switching to CO_2 welding, resulting in increased metal deposition rates and better operator control. (K1d)

135-K. Magnetic Flux Combines With Carbon Dioxide to Shield Arc. *Machinery,* v. 63, March 1957, p. 178-179.

Continuously fed electrode wire that is magnetically coated with flux and shielded in an inert-gas atmosphere is the basis of a new Unionarc welding method. Weld deposition rate is increased over that realized with coated electrodes. (K1a)

136-K. Here's a New Welding Process. *Steel,* v. 140, March 4, 1957 p. 126-128.

Linde's Unionarc combines continuously fed wire electrode, carbon dioxide, magnetic flux and direct current to produce strong, smooth welds in mild steel with higher deposition rate than conventional coated electrodes. (K1a)

137-K. Inert-Gas Tungsten-Arc Butt Welding of Zircaloy-2 Tubes. J. W. Lingafelter. *Welding Journal,* v. 36, March 1957, p. 230-235. (CMA)

A length of internally ribbed Zircaloy-2 tube was produced in a tube butt-welding operation using inert-gas and the tungsten arc technique. The precedure is adaptable to automatic operation. The welds contained no significant porosity and no corrosion products were evident in the corrosion tests. (K1d; Zr, 4-10)

138-K. (French.) **Good Silver Brazing Demands Six Conditions.** A. W. Swift. *Machine Moderne et Revue Mecanique,* no. 575, Feb. 1957, p. 8-10.

To obtain solid and nonporous silver brazed joints attention must be paid to correct spacing, cleanliness, careful application of flux, adequate support of the parts during the operation, heating and rapid removal of the flux. (K8; *Ag*)

139-K. (French and German.) **The New Brown Boveri Automatic Arc-Welding Machine.** A. Schmid. *Zeitschrift für Schweisstechnik,* no. 2, Feb. 1957, p. 28-37.

Details concerning the construction and operation of the new Brown Boveri U1200 automatic welding machine. Describes its adaptability for all types of arc welding, the simplicity of its electrical control mechanism and the ease in the manipulation of the electrodes and core wire. (K1, 1-2)

140-K. Brazing Beryllium Tubing to High-Temperature Alloy Collars. K. G. Wikle and R. Magalski. Brush Beryllium Co. *U.S. Atomic Energy Commission,* COO-310, June 1956, 22 p.

A vacuum-furnace brazing technique by which beryllium tubes can be lap brazed to Type 405 stainless steel and other high-temperature alloys has been developed. The resultant lap joints have a shear strength up to about 7000 to 8000 psi. at 750° F. 6 ref. (K8, 1-23; SS, Be, 4-10)

141-K. Joint Design for Making Root Pass Welds Without Filler Material. L. C. Lemon and W. R. Smith. General Electric Co. *U.S. Atomic Energy Commission,* HW-44245, July 9, 1956, 15 p.

Several joints were evaluated and both the consumable insert joint and the newly developed "G.E." joint appeared to fulfill the requirements. Both joints provide a weld whose quality can be determined by visual inspection of the near side of the weld, and both can be made with the minimum of welder skills and training. The consumable insert joint is the more costly because of the longer time required for machining, fitting, and welding, and because of the high cost for the individual insert. (K1, 17-1)

142-K. Welding of Type 347 Steels. Statistical Analysis of the Effect of Various Elements on the Crack Sensitivity of Fully Austenitic Type 347 Welds. Arthur Hoerl and Thomas J. Moore. Arcos Corp. *U.S. Atomic Energy Commisssion,* NYO-3500, Oct. 29, 1956, 25 p.

Carbon and manganese are shown to be the most potent elements in reducing cracking, and phosphorus and sulphur are the strongest and most definite crack promoters. (K general, 2-10, 9-22; SS)

Cleaning, Coating and Finishing

120-L. Ultrasonic Deburring. John P. Wright. *American Machinist,* v. 101, Feb. 11, 1957, p. 129-136.

Case history involving precision gears, clutch drum, precision spacers, recording needle and other applications demonstrate ultrasonics ability to remove microscopic burrs, radius edges, improve surface finish and clean part. (L10f, G24c)

121-L. Aluminum-Coat Steel Parts for All-Weather Wear. R. F. Joy. *Iron Age,* v. 179, Feb. 7, 1957, p. 106-107.

Utility pole hardware is coated by simplified process, including precleaning in fused salt, pickling, preheating in salt bath and coating. (L16, L12; ST, *Al*)

122-L. Dip Coatings, Chromium Cut Galling of Titanium. *Materials and Methods,* v. 45, Feb. 1957, p. 148-149. (CMA)

Protective coatings can be deposited on titanium which minimize its tendency to gall and oxidize. Conversion coatings are preferable to anodic and immersion coatings from an economic and operational viewpoint. The chemical baths used were fluoride-phosphate and fluoride-borate types, and are run at about 185° F. Chromium electrodeposits may be formed on a prior titanium fluoride film by use of a conventional plating bath; heat treating the plate at 1470° F. is necessary. (L14; Ti, *Cr*)

123-L. Processes and Techniques for Achieving Extreme Surface Hardness and Wear Resistance. Frank J. Rizzo. *Metal Treating,* v. 8, Jan.-Feb. 1957, p. 8-9; disc., p. 33.

Methods employed in hard chromium plating of aluminum and titanium, pretreatment, coating characteristics. (L17; Al, Ti, *Cr*)

124-L. How to Color Anodized Aluminum. B. M. Phelan. *Modern Metals,* v. 13, Feb. 1957, p. 35-39.

Coloring characteristics of Alumilite, chromic acid, oxalic acid processes; pretreatment and process steps for each; basic conditions; dyes and dyebaths; stripping faulty films; special effects. (L14, L19; Al)

125-L. Effects of Impurities in Cyanide Plating Solutions. H. L. Benner and R. R. Bair. *Plating,* v. 44, Feb. 1957, p. 151-155.

Deleterious effects, objectionable limits and corrective measures for metals and other materials frequently contaminating zinc cyanide solutions with or without brighteners, high and low-efficiency copper plating solutions, cadmium-silver plating solutions and brass plating solutions. (L17a)

126-L. Anodized Aluminum for Automobile Trim Parts. C. F. Nixon and H. A. Kahler. *Plating,* v. 44, Feb. 1957, p. 156-160.

Modern appearance, ease of fabrication and corrosion resistance have increased the use of anodized aluminum trim on G.M. cars. Sequence of operations used in the anodizing process. (L19, T21; Al)

127-L. Economics of Treatment of Strong Chromic Acid Solutions. George E. Glover. *Plating,* v. 44, Feb. 1957, p. 161-165.

Relative costs of destruction and replacement or recovery with ion exchange resins for varying degrees of metallic contamination of strong chromic acid solutions. (L17a; *Cr*)

128-L. Effects of Impurities and Purification of Electroplating Solutions. A. J. Smith and Ralph Bacon. *Plating,* v. 44, Feb. 1957, p. 186-187.

Addition of 700 ppm. calcium to Watts solution, organic bright solution and nickel-cobalt bright solution had no effect on appearance,

ductility, throwing power, hardness, adhesion or corrosion resistance of electrodeposited nickel. No satisfactory methods found for eliminating calcium. (L17a; *Ni*)

129-L. Corrosion Protection From Vacuum-Bonded Clad Material. R. C. Bertossa. *American Brewer,* Feb. 1957, p. 47-48, 65.

Vacuum-brazed clad products are finding uses in corrosion-resistant service, in brewing and other industries; advantages of vacuum brazing; techniques of high-vacuum and flux-free cladding. (L22, K8, 1-23)

130-L. Chelating Agents in Metal Cleaning and De-Rusting. J. K. Aiken and C. Garnett. *Electroplating and Metal Finishing,* v. 10, Feb. 1957, p. 31-35.

E.D.T.A. (ethylene-diamine-tetra-acetic acid) group of chelating agents is characterized by its a ability to "dissolve" water-insoluble metal oxides and hydroxides, carbonates, sulphates and phosphates which are formed when metals corrode. E.D.T.A. is thus valuable in special-purpose cleaning compositions for metals and also as an additive to conventional alkaline cleaners. (L12p)

131-L. Electrodeposition From Sulphamate Solutions. Part III. Nickel-Zinc Alloys. S. Sathyanaraya and T. L. Rama Char. *India Section, Electrochemical Society, Bulletin,* v. 5, Oct. 1956, p. 83-85.

A bath containing nickel and zinc sulphamates used for the co-deposition of nickel and zinc. At cathode efficiencies close to 100%, the nickel content in the alloy deposit is very low. It is possible to increase the nickel content to high values at the sacrifice of efficiency. 8 ref. (L17a; Ni, Zn)

132-L. Chemical and Electrolytic Polishing of Surfaces—Part I. P. Grivel. *Industrial Finishing,* v. 9, Jan. 1957, p. 339-341, 345.

Seven chemical polishing solutions of American or German origin were tested on brass, nickel silver, bronze, cupro and copper strips. The degree of polish was evaluated and compared. (To be continued.) (L10f, L13p; Cu, Ni, Ag)

133-L. Why Centerless Brushing Finishes Faster. R. C. Sasena. *Iron Age,* v. 179, Feb. 21, 1957, p. 91-93.

Power brushing without centering chucks speeds work which varies from deburring to satin finishing; for tasks ranging from cleaning bar stock to polishing pistons. (L10e)

134-L. Silicone Coatings for Metal Products. L. F. Stebleton. *Materials and Methods,* v. 45, Feb. 1957, p. 112-115.

General discussion of silicone coatings and their uses where resistance to heat, moisture and corrosive conditions are advantageous. (L26p; NM-33)

135-L. Burnishings for Profit. Ted Brolund. *Metal Removing,* v. 1, Feb. 15, 1957, p. 23-25.

Method of surface finishing where hardened steel or carbide is slid or rolled over a surface made of a softer ductile material under extreme pressure. Advantages over grinding. (L10g)

136-L. Developments in Protective Processes: the Phoscadising Process. *Product Finishing,* v. 10, Jan. 1957, p. 64-67.

Details of three-stage operation involving electrical deposition of phosphate alloy, phosphate coat, alloy coat and sealing coat. (L14b)

137-L. Titanium Coating and Its Application. I. Titanium Cementation. T. Yamaguchi, K. Hirayama and T. Takei. *Tokyo Scientific Research Institute, Journal,* v. 50, Dec. 1956, p. 247-252. (CMA)

Iron and steel acquire a titanium coating when contacted with the powder at 950 to 1200° C. under reducing conditions. The activation energy of the diffusion process is estimated to be 58-62 k-cal. The structure of the highly corrosion resistant coat includes an outer titanium layer (β solid solution) and an inner $TiFe_2$ columnar layer. Influences of time and temperature were studied analytically; 0.3% carbon in the steel decreases the thickness of the layer by 2/3 and makes for nonuniformity. (L15; ST, *Ti*)

138-L. (English.) **Stainless Plated Plates.** *Aciers Fins et Speciaux Francais,* no. 24, Dec. 1956, p. 73-75.

French methods of manufacturing stainless steel clad plates; manufacture, rolling and treatment; grades of steels most commonly used; advantages derived from the use of the plate (including an improvement in thermal conductivity and mechanical strength). (L22, F23; SS, 4-3)

139-L. (French.) **Trend to Plastic Coatings in Corrosion Prevention.** L. Remy. *Corrosion et Anticorrosion,* v. 4, June 1956, p. 217-221.

Nature and applications of plastic coatings; analyzes protection afforded. (L26p)

140-L. (French.) **Surface Treatment of Titanium.** H. Richaud. *Corrosion et Anticorrosion,* v. 4, Dec. 1956, p. 400-402. (CMA)

A brief description of the processes of anodic oxidation of the surface layer of titanium, and of electroplating of titanium with coatings of copper, nickel, chromium, etc. Such coatings are deposited on an intermediary layer of oxide or on a coating of zinc. Mention is made of the brazing procedure in which titanium parts are joined by means of electrolytic coatings of 60% Ag, 32% Cu and 8% Zn (deposited simultaneously or, preferably, successively); parts so coated and assembled are brazed in a furnace for 30 min. at 800° C. 1 ref. (L19, L17, K8k; Ti)

141-L. (French.) **Zinc Plate on Steel Cartridge Cases.** *Galvano,* no. 240, Jan. 1957, p. 19-24.

Zinc plating processes, equipment and methods at the Norris-Thermador Corp., Los Angeles. (L17; ST, *Zn*)

142-L. (French.) **Influence of Chromizing on the Oxidation Resistance of Steels and of Nickel and Cobalt Alloys.** R. L. Samuel and T. P. Hoar. *Galvano,* no. 240, Jan. 1957, p. 33.

Notes that the diffusion of chomium, or chromatizing, produces better resistance to oxidation at high temperatures for a large number of metals and alloys such as iron, nickel and cobalt. (L15, R1h, 2-12; Ni, Co, *Cr*)

143-L. (French.) **Surface Treatment Prior to Galvanizing: Degreasing.** A. Herz. *Métallurgie et la Construction Mécanique,* v. 89, Jan. 1957, p. 49-51.

Proper preparation of the surface. Degreasing methods must be selected according to the nature of the metal and fatty substances; description of degreasing by use of an alkaline solution, surface tensions, wetting agents, influence of the pH. Discusses regeneration of baths and gives practical advice on the conduct of the operation. (L12k, L16, ST, *Zn*)

144-L. (French.) **Aluminum Coating of Iron and of Ferrous Metals.** Louis Grand. *Revue de l'Aluminium,* no. 239, Jan. 1957, p. 63-73.

The protection of iron by a thin aluminum coating extends to a cheap metal the high resistance to corrosion, good behavior under high temperatures and fine aspect of the light metal. This coating process necessitates a complete elimination of oxide films between the two metals, reducing to a minimum the fragile intermetallic zone. The deposition of aluminum, after sand blasting or pickling, must be carried out under a neutral or reducing atmosphere, in a volatile liquid or in the presence of a flux enabling the aluminum to thoroughly "wet" the iron. Bath temperature and immersion time must be reduced so as to obtain a flexible deposit. 3 ref. (L15; Fe, *Al*)

145-L. (French.) **Surface Treatment of Aluminum and Its Alloys. Electrolytic Treatment—Anodic Oxidation. The Sulphuric Process.** Charles Etienne and Francois Flusin. *Revue de l'Aluminium,* no. 239, Jan. 1957, p. 89-99.

Discusses the adjustment of the operation conditions so that the oxidation speed notably exceeds the dissolution speed and the anodic film does not feature a granular texture. Practical data are given on the conditions of oxidation for pure aluminum and for the main alloys. Reviews influence of the concentration of the electrolyte, temperature, current density and time of oxidation. (L19n; Al)

146-L. (French.) **Treatment of Surfaces Before Cold Working by the Process of Phosphating.** M. Lefevre. *Revue Générale de Mécanique,* no. 95 (new series), Dec. 1956, p. 403-406.

Phosphating as a chemical process, advantages gained by the use of phosphate coatings in the drawing of steel. (L14b, G4; ST, NM-h)

147-L. (German.) **Galvanizing Screws and Other Small Parts. I.** Werner Peters. *Draht,* v. 8, Jan. 1957, p. 7-13.

Qualitative requirements and preparation of screws, springs, wire-bending devices, etc., for the galvanizing process. (L16, T7; *Zn*)

148-L. Exterior Aluminum Cleaning. *Cleaning and Maintenance,* v. 5, Feb. 1957, p. 4-41.

Unanodized aluminum and anodized aluminum evaluated in relation to corrosion and cleaning in rural, industrial and marine atmospheres. (L12, R3; Al)

149-L. Kinetics of Metal Deposition: Polarography Using Stationary Microelectrodes. *Electrochemical Society, Journal,* v. 104, Feb. 1957, p. 116-123.

Current-voltage curves arising from metal deposition were determined using a variety of stationary micro-electrodes, mostly vertical wires, and the concentration polarization approximated that expected from convective diffusion. An equation is formulated that can be used to calculate limiting current densities during alloy formation. 22 ref. (L17, 1-4)

150-L. Nitriding Curbs Rust on Cans. J. R. Marshall. *Food Engineering,* v. 29, Feb. 1957, p. 99-102.

Remedy for rust indicated in the sodium nitrite treatment; testing techniques. (L15, T28)

151-L. A Note on Salts in Galvanizing. A. Gordet. *Galvano,* no. 240, Jan. 1957, p. 38-40.

Discusses the role of fluxes—ammonium zinc chloride, sodium chloride and ammonium chloride—in hot dip galvanizing, and stresses that the thickness of the coating applied depends on the duration of immersion, speed of withdrawal from the bath and the temperature.
(L16; *Zn*, RM-q)

152-L. The Chemical and Electrolytic Polishing of Surfaces—Part II. P. Grivel. *Industrial Finishing*, v. 9, Feb. 1957, p. 400-401.

Electrochemical method based on the anodic dissolution of the element to be polished. Two systems are used, one has a resistance in series and the other has two resistances in parallel. Table of bath compositions for nonferrous metals is included. (L13p)

153-L. Metal Cleaning and Finishing by the Airless Abrasive Blasting Process. F. W. Pedrotty. *Institute of Production Engineers, Journal*, v. 36, Feb. 1957, p. 128-135.

Cleaning castings, removing scale from forgings, removing heat treating scale, cleaning weldments and preparing surfaces for final finishing by airless abrasive process. Types and sizes of ferrous abrasives described. (L10c, 9-2)

154-L. A Method of Determining the Sag Resistance of Porcelain Enameling Steels. H. D. Gonaway. *Metal Products Manufacturing*, v. 14, Mar. 1957, p. 32-33.

Investigation of five methods for supporting specimens and the equipment and methods for conducting steel sag tests. (L27, 1-14; ST)

155-L. The Role of Oxygen in Iron-Enamel Adherence. *Metal Products Manufacturing*, v. 14, Mar. 1957, p. 35-36, 87.

Evidence indicates interface roughness does not completely account for porcelain enamel adherence; work is needed to isolate other mechanisms in vitreous coating adherence. Controlled atmosphere tests are discussed. (L27, Q10c)

156-L. Vitreous Enamelling Aluminum Tiles. *Product Finishing*, v. 10, Feb. 1957, p. 86-90.

3S aluminum alloy strip is drawn through a six-stage cleaning and Alodizing process, thereby eliminating prefiring. After stamping, the tiles are spray coated, then baked in an electrically heated convection-type furnace. (L27; Al)

157-L. Protective Coatings for Titanium. *Products Finishing*, v. 21, March 1957, p. 44-46. (CMA)

A method of electrodepositing protective coats on titanium involves a pretreatment consisting of degreasing and cleaning the surface, suspension in a solution of hydrogen fluoride and acetic acids for 10-15 min., and passing 60-cycle ac. through the specimen for 10 min. The rinsed specimens may then be transferred to a chromium plating bath. The formation of an oxide film is thus prevented.
(L12, L13, L17; Ti, *Cr*)

158-L. Metal Drums Coated Centrifugally. *Steel*, v. 140, March 4, 1957, p. 94.

Steel drums are held stationary while spinning rotor travels through them and sprays on atomized coating. Variety of materials including phenolics and vinyls may be applied with high thickness accuracy by centrifugal spraying. (L26; ST)

159-L. Strand Bonderizing. *Wire Industry*, v. 24, Feb. 1957, p. 169, 173.

A new coating process developed by the Pyrene Co. Ltd., Middlesex, England, in which it is possible to handle 24 strands of wire with speeds up to 60 ft. per min.
(L14b; ST, 4-11)

160-L. (French.) **Trend to Plastic Coatings in Corrosion Prevention.** L. Remy. *Corrosion et Anticorrosion*, v. 4, June 1956, p. 217-221.

Analysis of the corrosive mechanism; nature and applications of protective coatings such as polyvinyl and polyethylene; methods of coating; anticorrosive protection afforded. (L26p)

161-L. (French.) **Improvement in Resistance to Corrosion by Metallic Coatings Other Than Those Produced by Electroplating.** *Pratique des Industries Mecaniques*, Dec. 1956, p. 335.

Describes the metallizing or metal-spraying process using an oxy-acetylene or oxypropane gun; indicates conditions required for optimum results. (L23, 1-2)

162-L. Electrodeposition of Titanium. Part 3. E. W. Reid, Jr., J. H. Connor and A. Brenner. U.S. National Bureau of Standards (Wright Air Development Center). *U.S. Office of Technical Services*, PB 121721, Sept. 1956, 18 p., $.50.

Study of baths of an ether and a soluble reactive titanium compound in an effort to increase titanium content of the alloys over the 6.5% previously obtained. The possibility of using sodium or potassium borohydride instead of lithium borohydride to prepare titanium and zirconium borohydrides was examined. (L17a; Ti)

Metallography

Constitution and Primary Structures

101-M. Structure of Mercury at Low Temperature. C. S. Barrett. *Acta Crystallographica*, v. 10, Jan. 10, 1957, p. 58-60.

The rhombohedral structure of mercury is retained on cooling to 5° K., and the transformation detected by Bridgman at pressure of 10,000 atmospheres and above does not extend to atmospheric pressure. A polycrystalline sample cold worked at 5° K. and run at 5, 78 and 206° K. showed similar diffraction patterns at each temperature, with no evidence of transformation. 14 ref.
(M26n, 2-13; Hg)

102-M. Metal Oxide Solid Solutions. Part I. Lattice Constant and Phase Relationships in Ferrous Oxide (Wustite) and in Solid Solutions of Ferrous Oxide and Manganous Oxide. P. K. Foster and A. J. E. Welch. *Faraday Society, Transactions*, v. 52, Dec. 1956, p. 1626-1635.

Determination of lattice constants for ferrous oxide (wustite) at 1000° C. over the composition range in which this nonstoichiometric phase is stable. 13 ref. (M26r; Fe, 14-17)

103-M. Influence of Impurities on the Recrystallization Texture of Cold-Rolled 3% Silicon Iron. J. D. Fast. *Philips Research Reports*, v. 11, Dec. 1956, p. 490-491.

A procedure invented by Goss to produce polycrystalline silicon-iron sheet wherein the component crystals are oriented such that one of their directions of easiest magnetizations is nearly parallel to the direction of cold rolling. A study of the mechanism is reported.
(M26c, 3-19; Fe, *Si*)

104-M. Lattice Constants and Brillouin Zone Overlap in Dilute Magnesium Alloys. F. W. von Batchelder and R. F. Raeuchle. *Physical Review*, v. 105, Jan. 1957, p. 59-61.

The lattice constants of primary solid solutions of indium, aluminum and cadmium in magnesium as a function of composition. The linearity of the (c/a) vs. concentration curve for magnesium-aluminum has suggested that electron zone overlap does not necessarily lead to axial ratio anomalies and that changes in short-range order may be needed to explain such anomalies.
(M26p; Mg, *In, Al, Cd*)

105-M. The Interaction of Solutes With Dislocation Walls. W. W. Webb. *Acta Metallurgica*, v. 5, Feb. 1957, p. 89-96.

Calculation of the elastic interaction of solutes with dislocation walls has indicated that atmospheres of excess solute atoms may form at small-angle grain boundaries but are subject to saturation effects accompanied by a distinctive temperature dependence. Comparison is made with some available experimental data. (M26b)

106-M. Engineering Properties. V. Composition in Simple Binary Alloys. L. M. Elijah and D. J. Mack. *Engineering Journal*, v. 40, Feb. 1957, p. 141-143.

Investigations were made to show qualitatively how engineering properties vary with gross composition in mechanical mixture alloy systems. Results obtained were discussed for the zinc-lead system and tin-lead system.
(M26b, Q general; Zn, Sn, Pb)

107-M. Where New X-Ray Techniques Solve Old Shop Problems. *Iron Age*, v. 179, Feb. 14, 1957, p. 119-121.

Diffractometer records directly both intensity and angular diffraction of X-rays permitting quantitive analysis of phases present. Detection of stresses in hardened steel and determination of orientation. Instrument with slight modification can be used for determining chemical composition. (M22g, Q25, S11p)

108-M. The Structure, Deformation, and Fracture of Pearlite. Part II. Deformation and Structure. K. E. Puttick. *Iron and Steel Institute, Journal*, v. 185, Feb. 1957, p. 167-176.

Results of a study of plastic deformation and fracture of pearlitic steel by optical and electron microscopy. Techniques developed for the purpose include (a) a two-stage replica process for electron microscopy, using Perspex as the intermediate material and evaporated carbon as the final film, suitable for reproducing rough surfaces, including fracture surface, and (b) photogrammetry of stereoscopic pairs. 21 ref.
(M27d, Q26, M21e, M23c; ST)

109-M. Electron Microscopy of Aluminum Crystals Deformed at Various Temperatures. T. S. Noggle and J. S. Koehler. *Journal of Applied Physics*, v. 28, Jan. 1957, p. 53-62.

Deformation of 99.994% pure aluminum single crystals at 4.2, 78 and 295° K. (M26n, M21e; Al, 14-11)

110-M. Magnetic Structure in Copper-Manganese Alloys. David Menechetti and S. S. Sidhu. *Physical Review*, v. 105, Jan. 1, 1957, p. 130-135.

A neutron diffraction study of a series of substitutional solid solutions up to 85 at. % manganese in copper at about 13 at. % manga-

nese; a broad intensity maximum appears in the region (100) reflection of the face-centered cubic pattern of copper.
(M27g, M22j; Cu, Mn)

111-M. Surface Structures and Ferromagnetic Domain Sizes. D. H. Martin. *Physical Society Proceedings, Section B,* v. 70, Jan. 1957, p. 77-84.

Studies of the domain structures in the surface layers of crystals of iron and silicon-iron having (111) and (hol) type faces have permitted calculations to be made of the optimum domain sizes in iron crystals as dependent on the crystallographic orientations of their faces and their sizes. 7 ref. (M27g, Fe, Si)

112-M. Changes in Domain Structure Accompanying Reduction in Depth of a Single Crystal of Silicon Iron. L. F. Bates and H. Hart. *Proceedings of the Physical Society,* v. 69B, Dec. 1, 1956, p. 1200-1204.

Bitter patterns reveal marked changes in the domain structure of a Néel—cut crystal of silicon-iron when the crystal dimension perpendicular to a (110) plane is sufficiently reduced and suggest the formation of a new structure with an energy comparable with that of the normal Néel type. 7 ref. (M27g; Si, Fe, 14-11)

113-M. Solid Solution in the GaSb-InSb System. J. C. Woolley, B. A. Smith and D. G. Lees. *Proceedings of the Physical Society, Section B,* v. 9, Dec. 1, 1956, p. 1339-1343.

X-ray measurement to determine line intensity versus Bragg angle and lattice parameter at several annealing temperatures. 7 ref. (M24d, M22g)

114-M. (German.) Relationship Between Nuclear Physics and Metallography. Berta Karlik. *Berg und Hüttenmännische Monatshefte,* v. 101, Nov. 1956, p. 210-213.

Construction of nuclear reactors; application of metallography in nuclear reactor technology; construction of nuclear reactors, disintegration products of metals caused by nuclear radiation.
(M general, W11, P18h)

115-M. (German.) Neutron Diffraction. Karl Lintner. *Berg und Hüttenmännische Monatshefte,* v. 101, Nov. 1956, p. 238-246.

Special application to ferromagnetic and diamagnetic materials discussed and examples given. 23 ref. (M22j; SGA-n)

116-M. (Italian.) Structure and Properties of Metals. Part III. Alloys. R. Fieschi and M. Tosi. *Ingegneria Meccanica,* vol. 5, Sept. 1956, p. 5-8.

On the basis of preceding discussion of ideal and real metals, substitutional and interstitial alloys are now considered, with particular reference to steels. (M26p)

117-M. (Italian.) Structure and Properties of Metals. Part II. Real Metals. R. Fieschi and M. Tosi. *Ingegneria Meccanica,* v. 5, August 1956, p. 57-62.

Principal differences between ideal solids and real solids. Among imperfections present in real solids, particular consideration is given to dislocations and their importance to an understanding of the mechanical properties of metals. (M26b)

118-M. On the Sulfides, Selenides and Tellurides of Palladium. Fredrik Gronvold and Erling Rost. *Acta Chemica Scandinavica,* v. 10, no. 10, 1956, p. 1620-1634.

The phase relationships in the system palladium-sulphur, palladium-selenium and palladium-tellurium studied by means of X-rays. Density determinations and magnetic susceptibility measurements were also done. 25 ref.
(M24b, P10a, P16, 1-3; Pd)

119-M. X-Ray Diffraction Effects of Atomic Size in Alloys. Bernard Borie. *Acta Crystallographica,* v. 10, Part 2, 1957, p. 89-96.

To treat the effect of the difference in size of the atoms in a disordered binary alloy, the elastic model of Huang is modified to treat the two kinds of atoms as two different kinds of distortion centers in an average lattice. (M25, M22g)

120-M. The Crystal Structure of Antimony Selenide, Sb_2Se_3. N. W. Tideswell, F. H. Kruse and J. D. McCullough. *Acta Crystallographica,* v. 10, part 2, 1957, p. 99-102.

The isomorphism of antimony selenide (Sb_2Se_3) with antimony sulphide (Sb_2S_3) has been confirmed through a redetermination and refinement of the structure of antimony selenide. (M26q; Sb, Se)

121-M. The Structure of α(V-Al). P. J. Brown. *Acta Crystallographica,* v. 10, Feb. 10, 1957, p. 133-135. (CMA)

An aluminum-rich compound in the vanadium-aluminum system was shown to be isomorphous with $Mg_3Cr_2Al_{18}$. Each vanadium atom is surrounded by 12 aluminum atoms to form a nearly regular icosahedron. The icosahedra are linked together in the (110) direction, sharing aluminum atoms. There are 16 vanadium and 16 aluminum atoms per cell; the parameter a = 14.492 Å. (M26q; V, Al)

122-M. The Constitution of Titanium-Rich Alloys of Titanium, Aluminum, and Oxygen. T. H. Schofield and A. E. Bacon. *Institute of Metals, Journal,* v. 85, Jan. 1957, p. 194-195. (CMA)

A phase study of titanium alloys with an aluminum content up to 7.5% and oxygen up to 1% was conducted by microscopy methods up to 1250° C. Boundaries are more closely bracketed than in previous work and the (alpha + beta) beta boundary was determined at higher aluminum contents. The combination of oxygen and aluminum stabilizes α to higher temperatures than the sum of the two separately. The form of "transformed beta" depends on oxygen content and quench severity. (M24c; Ti, *Al, O*)

123-M. Thermodynamic Investigation of Nonmetallic Inclusions in Steel—II. Behavior of Titanium, Zirconium and Vanadium Nitrides and Carbides; and Their Effect on Austenite Grain Size of Steel. H. Sawamura and T. Mori. *Kyoto University, Faculty of Engineering, Memoirs,* v. 18, Oct. 1956, p. 402-413. (CMA)

Thermodynamic calculations were made for the formation of titanium, vanadium and zirconium nitride and carbide inclusions in steel. The inclusions do not effectively refine the grain size of austenite unless they are below a critical size. Vanadium and titanium inclusions are more stable than those of zirconium. Inclusions formed in molten steel are larger, and thus less effective, than those formed in solid steel.
(M27c, P12, 9-19; ST, *Ti, Zr, V*)

124-M. The Microstructural Appearance and Identification of Hydrides in Zirconium and Zircaloy-2. Hydrogen Alloys. G. B. Wadsworth, M. L. Picklesimer and G. M. Adamson, Jr. *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 186-208. (CMA)

The hydride phase in zirconium and Zircaloy-2 may be located and identified by anodizing the polished and etched surface in a buffered bath to give a film of ZrO_2 showing intereference colors. Hydrides appear yellow while the matrix is purple to blue. A mercury quenched specimen retained much hydrogen in supersaturation. Details of the procedure are described.
(M27d, 1-4; Zr, *H*)

125-M. (Hungarian.) Some Observations on Aluminum-Titanium-Vanadium Alloys. Robert K. Vassel. *Kohäszati Lapok,* v. 11, no. 11-12, 1956, p. 527-528. (CMA)

Single-phase aluminum-titanium-vanadium alloys seem even more promising in the high-temperature range than the usual titanium-base alloys. It has yet to be determined what the effect of an increase of the aluminum content from the usual 5-7% to the metallographically permissible 25-30% (limit of the single-phase field) would entail. 10 ref. (M24c; Al, Ti, V, 2-12)

N Transformations and Resulting Structures

93-N. Modern Heat Treatment. Adrian A. Hofman. *Australasian Engineer,* No. 43, Dec. 7, 1956, p. 47-55.

Discussion of time-temperature transformation curves and modern heat treatment methods. Reference to the relationships between transformations conducted isothermally and on continuous cooling, and examples of practical procedure and results obtained. (N8g, J general)

94-N. Diffusion in Ordered and Disordered Copper-Zinc. A. B. Kuper, D. Lazarus, J. R. Manning and C. T. Tomizuka. *Physical Review,* v. 104, Dec. 15, 1956, p. 1536-1541.

The measurement of diffusivities of copper, zinc and antimony in single crystals of 47-48 at. % Zn, copper-zinc (beta brass) over the temperature range 265-817° C., by using section techniques.
(N1a; Cu-n, 14-11)

95-N. Evidence for Vacancy Mechanism in Intermetallic Diffusion. L. Slifkin and C. T. Tomizuka. *Physical Review,* v. 104, Dec. 15, 1956, p. 1803-1804.

Vacancy mechanism in intermetallic diffusion of binary ordered alloy of the type AB. (N1c)

96-N. A Resistometric Study of the Kinetics of Precipitation in Lead-Tin Alloys. G. Borelius and L. E. Larsson. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 67-75.

The study of the precipitation process in two lead-tin alloys containing 19.2 and 23.5 at. % tin by measuring the resistivity as a function of time at a number of constant temperatures. 6 ref.
(N7b, 1-4; Pb, *Sn*)

97-N. Precipitation of the Theta Phase in 1632 Aluminium-4% Copper Alloys. G. Thomas and J. Nutting. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 57-66.

Effects of plastic deformation before and during the precipitation of the theta phase. Microstructures obtained have been interpreted by assuming the theta phase may nucleate and grow preferentially from immobile dislocations.
(N7, N2; Al, *Cu*)

98-N. Structure of the Omega Precipitate in Titanium-16% Vanadium Alloy. J. M. Silcock, M. H. Davies and H. K. Hardy. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 93-104.

Martensitic transformation in titanium alloys is suppressed by the presence of more than a critical concentration of a beta-stabilizing element. Decomposition of the quenched beta phase occurs by nucleation-and-growth processes and involves the formation of an intermediate precipitate, termed omega, the structure of which has been determined for the first time. 30 ref.
(N6q, N2; Ti, *V*)

99-N. Sigma-Phase Nucleation and Other Transformations During Diffusion in the Iron-Chromium System. H. J. Goldschmidt. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 105-119.

X-ray study of the progress of diffusion in powder compacts of iron and chromium for various temperatures, times and compositions. It has been possible to determine in this way the rate of solid-solution formation; in addition, some features observed are traced to a condition to the alpha lattice corresponding to incipient sigma formation or to a retarding influence of the gamma→alpha transformation upon diffusion. 13 ref. (N1; Fe, Cr, 6)

100-N. Martensitic Transformations. B. A. Bilby and J. W. Christian. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 121-172.

Definition of martensitic reactions should be based on the experimental observation of a change of shape in the transformed regions. Available crystallographic and kinetic data for all transformations of this type are reviewed. The nucleation process, and the possible roles of dislocations in these transformations, discussed. 166 ref. (N6q, N2)

101-N. Nucleation Problem in Martensite. M. A. Jaswon. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 173-185.

An outline of the dislocation-source theory of martensite nucleation, which is compared with the classical theory of Fisher, Hollomon and Turnbull. 48 ref. (N2, N6q)

102-N. Homogeneous Versus Heterogeneous Nucleation in the Martensitic Transformation. Larry Kaufman and Morris Cohen. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 187-191.

Determination of the M_s temperature of a series of iron-nickel alloys in order to decide whether the martensitic transformation is nucleated homogeneously or heterogeneously. 4 ref. (N6q, N2; Fe, Ni)

103-N. The Allotropic Transformation of Cobalt. Francois Sebilleau and Hervé Bibring. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 209-217.

Study of the behavior of cobalt after cold working has shown that recrystallization begins below the transformation temperature. This recrystallization takes place in two ways, depending on whether or not it is preceded by recovery of the metal. If not, the cobalt partially recrystallizes to the cubic form, and this cannot revert to the hexagonal form. On the other hand, metal which has previously undergone recovery recrystallizes completely in the hexagonal form. 15 ref.
(N5f, N6p; Co)

104-N. The Diffusionless Transformations of Metastable Beta-Brass. D. Hull and R. D. Garwood. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 219-227.

A metallographic study of two types of diffusionless transformation in metastable beta brass. The decomposition into "massive alpha" occurs during quenching in alloys of a critical composition (36.8-39.0% zinc). This transformation has the characteristics of a nucleation-and-growth reaction. 15 ref. (N6; Cu-n)

105-N. Crystallography of the Beta→Alpha Phase Transformation in Uranium-1.4 Atomic Per Cent Chromium Alloy. B. R. Butcher and A. H. Rowe. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 229-242.

Orientation relationships in the isothermal martensitic change of the beta phase to alpha phase in a uranium-1.4 at. % chromium alloy, using both a single-surface and a two-surface technique. By means of an X-ray Laue microbeam camera and micrographic work, two orientation relationships between the beta and alpha phases have been found. 17 ref. (N6q; U, *Cr*)

106-N. The Beta→Alpha Transformation in Uranium 1.4 Atomic Per Cent Chromium Alloy. W. M. Lomer. Paper from "Mechanism of Phase Transformation in Metals". Institute of Metals, 1956, p. 243-252.

A certain homogeneous strain can be found which will convert a single unit cell of beta-uranium into the same shapes as a small block of alpha-uranium structure. The actual atomic positions within this unit block require adjustment to complete the transformation. 9 ref.
(N6q; U, *Cr*)

107-N. Stabilization of Austenite. S. G. Glover and T. B. Smith. Paper from "Mechanism of Phase Transformation in Metals". Institute of Metals, 1956, p. 265-276.

Investigation of the thermal stabilization of austenite after partial transformation to martensite for a 1% carbon, 3% manganese steel. 37 ref. (N8p, AY, *Mn*)

108-N. X-Ray Determinations of Order and Atomic Sizes in Co-Pt Solid Solutions. P. S. Rudman and B. L. Averbach. *Acta Metallurgica,* v. 5, Feb. 1957, p. 65-73

The equilibrium long-range order in the alloy cobalt-platinum has been determined by means of X-ray intensity and lattice tetragonality measurements on powder briquettes quenched from various annealing temperatures. An elastic theory is used to determine the average atomic dimensions in solution from the lattice parameters and the bulk moduli. This result is then combined with the measured size-effect coefficients to provide information on the distortion of the shape of the atoms in solid solution.
(N10a, M25m; Co, Pt, 14-17)

109-N. Self-Diffusion in Dilute Binary Solid Solutions—II. E. W. Hart, R. E. Hoffman and D. Turnbull. *Acta Metallurgica,* v. 5, Feb. 1957, p. 74-76.

Diffusion phenomena in dilute silver solid solutions may be considered to consist of matrix of undisturbed solvent containing nonoverlapping "soft" regions around each solute atom. (N1d; Ag)

110-N. Strain-Aging of Aluminum Liquid-Air Temperatures. A. R. C. Westwood and T. Broom. *Acta Metallurgica,* v. 5, Feb. 1957, p. 77-82.

Measurements of increases in flow stress of polycrystalline superpure aluminum and aluminum-magnesium alloys following aging at liquid-air temperatures after prior deformation at the same temperatures indicate that some form of strain-aging occurs. 4 ref. (N7e, 1-13; Al, *Mg*)

111-N. Grain Growth in Metals. P. Feltham. *Acta Metallurgica,* v. 5, Feb. 1957, p. 97-105.

The sizes and shapes of grains in annealed metals, characterized respectively by the grain diameters and the interfacial angles, are shown to be lognormally distributed in planar sections as well as in space. The similarity of the size and shape distribution facilitates the treatment of grain growth as a univariant statistical problem in which the mean rate of growth of the grains is obtained as the resultant of the surface tension-controlled rate of growth of the individual grains in the distribution.
(N3m)

112-N. Influence of Impurities on the Macromosaic Structures of Tin and Lead. H. A. Atwater and B. Chalmes. *Canadian Journal of Physics,* v. 35, Feb. 1957, p. 208-215.

The properties and characteristics of arrays of low-angle boundaries which appear upon freezing of single crystals of tin and lead from the melt are shown to be dependent upon the amount and kind of impurities in the freezing liquid. The boundary direction angle as a function of lattice orientation and impurity as an observational quantity. Measurements of boundary-direction are given for various impurity concentrations and types.
(N12n, N12r, 3-19; Sn, Pb)

113-N. Studies on Electrolytic Condenser (Part 21). Studies on Deterioration of Anodic-Oxidized Film of Aluminum in Electrolyte by Electron Microscope. Ichiro Sate. *Denki Kageku,* v. 24, Nov. 1956, p. 506-511.

Examination with electron and photomicroscopes to study the deterioration of electrolytic condensers during storage. The transformation of the surface film by immersion in electrolyte. 10 ref.
(N12d, M21e; Al, 14-12)

114-N. Strain Ageing of Boron-Treated Low-Carbon Steels. E. R. Morgan and J. C. Shyne. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 156-160.

The efficiency of boron additions and commercial box annealing in suppressing nitrogen and carbon strain aging in alloys of commercial composition has been investigated. Results show that for all practical purposes boron-treated, box-annealed,

low carbon steels containing from 0.007 to 0.02% boron are nonaging. 13 ref. (N7e; CN-g, *B*)

115-N. The Structure, Deformation, and Fracture of Pearlite. Part I. Structure. K. E. Puttick. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 161-167.

Some features of pearlite structure revealed by electron microscopy are described and discussed. These include (a) a fine precipitate in the ferrite, formed after an aging treatment, of dimensions and spacing approximately 100Å, (b) inhomogeneity in the cementite shown by the rimmed appearance of etched lamellae, (c) branched crystallization of cementite, (d) linear discontinuities in the lamellar pattern, (e) bent and curved plates of cementite within a colony, (f) rod-like growth of cementite, (g) growth of cementite round inclusions. 17 ref. (N8h)

116-N. The Solubility of Nitrogen and Formation of Silicon Nitride in Iron-Silicon Alloys. E. T. Turkdogan and S. Ignatowicz. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 200-206.

Iron-silicon alloys containing 0.90, 1.26 and 2.83% silicon have been equilibrated with ammonia-hydrogen or nitrogen-hydrogen mixtures at various temperatures. The solubility of nitrogen in iron, in equilibrium with a nitride phase, is reduced appreciably by the formation of a silicon nitride. The inclusions in the nitrided alloys have been extracted and analysis shows that they consist of silicon nitride and silica; the latter forms during the extraction operation from the silicon in solid solution. 11 ref. (N16m; Fe, *Si*)

117-N. Isothermal Transformation of Lamellar Pearlites to Austenite. M. M. Labib, A. A. Golestaneh, C. Handford and G. Bullock. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 207-215.

The isothermal transformation of lamellar pearlites to austenite in a plain carbon eutectoid steel at supercritical temperatures examined using an electrical resistance technique. Relationship between interlamellar spacing, temperature and rate of transformation investigated and equations which express this relationship formulated. 23 ref.. (N8f; CN)

118-N. Effect of Structural Defects in Germanium on the Diffusion and Acceptor Behavior of Copper. C. S. Fuller and J. A. Ditzenberger. *Journal of Applied Physics,* v. 28, Jan. 1957, p. 40-48.

Effect of dislocations in germanium upon the diffusion of copper using germanium crystals having different etch-pit counts, as well as on germanium specimens bent on a (112) axis. (N1, P15g, M26b; Cu, Ge)

119-N. Self-Diffusion of Silver Palladium Alloys. N. H. Nachtrieb, J. Petit and J. Wehrenbert. *Journal of Chemical Physics,* v. 26, Jan. 1957, p. 106-109.

The self-diffusion of silver in alloys containing 0.00, 1.49, 3.69, 9.87 and 21.84 at. % palladium at four temperatures: 715.4, 799.4, 861.8 and 942.0° C. 11 ref. (N1d, 2-11; Ag, Pd)

120-N. Diffusion and Electrical Behavior of Zinc in Silicon. C. S. Fuller and F. J. Morin. *Physical Review,* v. 105, Jan. 15, 1957, p. 379-384.

Zinc has been diffused into silicon single crystals and elimination of diffusion constant and solubility have been obtained by conductivity measurements. Hall effect and conductivity measurements as functions of temperature have been made on silicon crystals containing diffused zinc. (N1b, P15g; Zn, Si)

121-N. Nucleation-and-Growth Processes in Metals and Alloys. H. K. Hardy and T. J. Heal. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p.1-46.

Examples of the thermodynamic-composition relationships underlying typical nucleation processes. The thermodynamics and kinetics of precipitation. Current information on the effect of plastic deformation on nucleation process. 194 ref. (N2, N7)

122-N. Effects of Nucleation Site Upon Precipitate Morphology. H. I. Aaronson. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 47-66.

Demonstration of two types of effects based on a metallographic investigation of pro-eutectoid ferrite morphologies in a plain carbon steel. A qualitative explanation in terms of interactions of the grain-boundary structure with the earliest stages of growth process. The second group of effects acts through a base layer of grain-boundary allotriomorphs and seems to determine the probability of secondary sideplates or secondary sawteeth developing from the allotriomorphs. 11 ref. (N2, N7)

123-N. Superlattice Formation in the Alloy $CdMg_3$. H. Steeple and H. Lipson. Paper from "Mechanism of Phase Transformations in Metals". Institute of Mteals, 1956, p. 77-85.

The optical-diffraction method of illustrating the process of superlattice formation in alloys, and some examples of diffraction patterns. It is shown that superlattice formation can be regarded as a process whereby similar atoms distribute themselves as evenly as possible on the lattice sites. 18 ref. (N10, 1-4; Cd, Mg)

124-N. The Beta→Alpha Transformation in Pure Tin and Its Dilute Alloys. E. O. Hall. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 87-92.

The mechanism whereby gray (alpha) tin disintegrates into small pieces as a result of the volume change on transformation. Compact pieces of gray tin can be produced by causing dilute alloys of tin to transform. 11 ref. (N6p, P10d; Sn)

125-N. Crystal Geometry of the Austenite-Martensite Transformation. T. L. Richards and W. T. Roberts. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 193-207.

For the purpose of analysis of the austenite-martensite transformation, it is assumed that transformation is equivalent to a combination of the simple Bain mechanism and a body rotation. 12 ref. (N8p)

126-N. The Bainite Reaction in High-Carbon Steels. O. Krisement and F. Wever. Paper from "Mechanism of Phase Transformations in Metals". Institute of Metals, 1956, p. 253-263.

Investigation of the influence of the precipitation of carbide in austenite on the bainite reaction in high-carbon steels. For higher carbon concentrations, formation of bainitic ferrite becomes possible adjacent to the surface of growing carbide particles, but it cannot form in an austenitic matrix of average carbon concentration. 18 ref. (N8m; CN-r)

127-N. (English.) **Chi Phase (Fe_2C) in Tempering Carbon Steels.** Minoru Okada and Yoshiaki Arata. *Osaka University, Technology Reports,* v. 6, Mar. 1956, p. 145-154.

In tempering of quenched carbon steels, the carbide existing in early part of the third stage has been investigated by means of magnetic analysis, graphitization test and X-ray diffraction test. As the result of these tests, the existence of the so-called chi phase has been confirmed. 10 ref. (N8a, 1-4; CN)

128-N. (French.) **On the Existence of a Plastic Deformation of Iron During the Transformation Alpha to Gamma and Gamma to Alpha.** Pierre Lehr. *Comptes Rendus,* v. 244, Jan. 2, 1957, p. 77-80.

Notes the existence of a plastic deformation of iron in the course of the transformation alpha to gamma and gamma to alpha which is indicated by photomicrographic study. Characteristics of this deformation. 7 ref. (N6p, Q24; Fe)

129-N. (Russian.) **Electron Diffraction Investigation of the Structure of Germanium Films Obtained by Vacuum Deposition.** S. A. Semiletov. *Kristallografiya,* v. 1, no. 5, 1956, p. 542-545.

Structure of germanium films deposited by sublimation in vacuum investigated and effects on this structure of the surface on which the film was deposited, temperature of this surface, rate of deposition, and thickness of the film studied. The fact that various types of orientation of microcrystals of germanium in films are possible was established. (N15g, 1-23; Ge, 13-12)

130-N. Metallographic Study of Electroplated Coatings of Chromium and Nickel on Molybdenum. R. J. Runck. *Electrochemical Society, Journal,* v. 104, Feb. 1957, p. 74-79. (CMA)

A metallographic study of single and multiple-layer electroplates of nickel and chromium on molybdenum showed that the latter electroplates in single layers were less subject to bonding failure and gave a better defense against oxidation; cracking was the main cause of failure. Multiple-layer coatings in which chromium is plated first may be superior, but blisters between coats are a hazard. 5 ref. (N12d, L17; Mo, *Ni, Cr*)

131-N. Structure of Chemically Deposited Nickel. A. W. Goldenstein, W. Rostoker, F. Schossberger and G. Gudzeit. *Electrochemical Society, Journal,* v. 104, Feb. 1957, p. 104-110.

Analysis of the structure of the nickel deposit produced by the catalytic nickel reduction process. X-ray and electron diffraction; metallographic examination, etching, platings, growth faults. 10 ref. (N12d, Ni)

132-N. (French.) **Observation of an Isothermal Change of Phase in Titanium at High Temperature.** Micheline Sorel-Sternberg. *Comptes Rendus,* v. 244, Feb. 4, 1957, p. 765-767. (CMA)

Cinematographic recording of emission electron microscope images of titanium crystals undergoing phase transformations is described. The experiments, performed at a constant temperature of 1200° C. and lasting a few hours, showed that the surface of crystals of beta ti-

tanium, originally uniform, was gradually covered by a net of growing V needles composed of a precipitate. Since the velocity of the process depended on the degree of the vacuum in the microscope, the phenomenon was interpreted as due to phase transformations in titanium-gas systems, principally the system titanium-oxygen. The needles represented α series in the transformation sequence beta→alpha + beta→alpha where alpha and beta are, respectively, solid solutions of oxygen in alpha and beta titanium. (N7c, 2-12, 1-4; Ti)

133-N. (Report.) **A Critical Review of the Mechanism of Aging in Alloys Based on the Aluminum Zinc-Magnesium System.** I. J. Polmer. *Australian Aeronautical Research Laboratories,* report ACA-59, Aug. 1955, 22 p.

Available literature concerning the effect of age hardening on the changes in structure and properties in alloys of the 75S type. Effect of addition elements, changes in microstructure according to X-ray investigations. (N7a; Al, *Zn, Mg*)

134-N. Nucleation of Voids in Metals During Diffusion and Creep. R. Resnick and L. Seigle. Sylvania Electric Products, Inc. *U.S. Atomic Energy Commission,* SEP-213, May 24, 1956, 35 p.

Voids formed during diffusion in brass are heterogeneously nucleated. The nuclei appear to be oxide particles, probably zinc oxide. When these are removed by re-melting, voids practically do not exist upon subsequent dezincification. Brass freed of void nucleation catalysts exhibited increased stress-rupture life. 18 ref. (N2, N1e, Q3m; Cu-n)

135-N. Morphology of Zircaloy-2. M. L. Picklesimer and G. M. Adamson, Jr. *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 165-185. (CMA)

The microstructures obtained from heat treating Zircaloy-2 were studied. Cooling rates affect the transformation and annealing time and temperature affects the beta quenched structure. Growth is slow for grains of alpha once they are equiaxed and for beta grains in all-beta structures. Intermetallic stringers are almost all dissolved in 30 min. at 1000° C. Beta structures differ in little but the size of the acicular alpha needles and the presence of intermetallics at grain boundaries, regardless of air or furnace cooling, water quenching or isothermal transformation. The preferred orientation is partially randomized by cold working water-quenched beta. (N6p, 2-14; Zr)

136-N. (Book.) **The Mechanism of Phase Transformations in Metals.** 346 p. 1956. Institute of Metals, 17 Belgrave Square, London S.W.1, England.

The 18 papers of the symposium are abstracted separately. The symposium is divided into two parts, one dealing with nucleation and growth processes and the other with martensitic transformations. (N2, N6q)

Physical Properties

81-P. Properties of Galium Indium Antimonide. J. S. Blakemore. *Canadian Journal of Physics,* v. 35, Jan. 1957, p. 91-97.

Electrical conductivity and photoconductivity, optical absorption and Hall effect for p-type specimens of polycrystalline material. (P15; Ga, In)

82-P. Surface Finish and Attenuation of Aluminum Waveguides. J. Allison and F. A. Benson. *Electronic Engineering,* v. 29, Jan. 1957, p. 36-38.

Calculation of attenuation in wave length. (P15; Al)

83-P. Metal-Oxide Solid Solutions. Part II. Activity Relationships in Solid Solutions of Ferrous Oxide and Manganous Oxide. P. K. Foster and A. J. E. Welch. *Faraday Society, Transactions,* v. 52, Dec. 1956, p. 1636-1642.

Determination of equilibrium oxygen pressures at 850, 1000 and 1150° C. for reduction of solid solutions of ferrous oxide (wustite) and manganous oxide to metal. 6 ref. (P12b; Fe, Mn, 14-17)

84-P. The Electrochemical Polarization of Silver Single Crystals in Cl. Part I. Structural Changes of (100) and (111) Faces Under Cathodic Conditions. M. Fleischman, J. Sowerby and H. R. Thirsk. *Faraday Society, Transactions,* v. 53, Jan. 1957, p. 91-100.

Investigation of the cathodic treatment at constant potential of (100) and (111) faces of silver prior to silver chloride formation. 24 ref. (P15, M26n; Ag)

85-P. Optical Properties and Oxidation of Evaporated Titanium Films. G. Hass and A. P. Bradford. *Optical Society of America, Journal,* v. 47, Feb. 1957, p. 125-129. (CMA)

Reflectances, transmittances and optical constants were measured for titanium films evaporated onto quartz and glass at low pressures. Films 100-300 Å thick had uniform transmittance through the visible spectrum and may be used as neutral density filters. The oxidation of titanium in air was measured by three optical principles; the oxidation rate equals that of aluminum at 25° C. but soon exceeds it. 9 ref. (P17, R1h; Ti, 14-12)

86-P. Effect of Monolayer Adsorption on the Ejection of Electrons From Metals by Ions. Homer D. Hagstrum. *Physical Review,* v. 104, Dec. 15, 1956, p. 1516-1527.

Effect of monolayer adsorption on total electron yield and on electron energy distribution; anomalous behavior of tungsten in the presence of hydrogen. (P15; W)

87-P. Electrical Properties of n-Type InAs. T. C. Harman, H. L. Goering and A. C. Beer. *Physical Review,* v. 104, Dec. 15, 1956, p. 1562-1564.

Measurement of Hall coefficient and resistivity as a function of temperature on uncompensated indium arsenide. 13 ref. (P15; In, As, 14-18)

88-P. Magnetic Susceptibility of Dilute Cu Alloys at Low Temperature. F. T. Hedgecock. *Physical Review,* v. 104, Dec. 15, 1956, p. 1564-1567.

Temperature dependence of the magnetic susceptibility of dilute copper-tin and copper-iron alloys measured between room temperature and 4.2° K. 13 ref. (P16, 2-13; Cu, *Sn, Fe*)

89-P. Magneto-Band Effects in InAs and InSb in DC and High Pulsed Magnetic Fields. S. Zwerdling, R. J. Keyes, S. Foner, H. H. Kohn and Benjamin Lax. *Physical Review,* v. 104, Dec. 15, 1956, p. 1805-1807.

In a magnetic field semiconductors and semimetals with small effective mass have quantized Landau level whose energy separations can become comparable to the energy gap or overlap of the bands. (P15; In, As, Sb)

90-P. Thermal Equilibrium in Nuclear Magnetic Cooling of Metals. C. Kittel. *Physical Review,* v. 104, Dec. 15, 1956, p. 1807-1808.

Study of the rate at which the conduction electrons come into thermal equilibrium with the nuclear spins at 20 micro degrees. (P18)

91-P. Specific Heats of Liquid Metals and Liquid Salts. T. E. Douglas. *Transactions of the ASME,* v. 79, Jan. 1957, p. 23-28.

Known data on specific heats examined on a volume basis; predicting of specific heats in cases for which no data exist is proposed. 9 ref. (P12r; 14-10)

92-P. (Finnish.) **The Equilibrium State of the System Ilmenite-HCl(aq)-$TiCl_4$-$FeCl_2$-TiO_2 (Amorph).** S. Wilska. *Suomen Kemistilehti,* v. 29, no. 11B, 1956, p. 195-199. (CMA)

Ilmenite solubility in HCl was studied; the equilibrium constant for the over-all dissolution reaction was determined such that $K_e = 2.41$. Thermodynamic values were also determined. The initial rate of solution of titanium was definitely higher in concentrated HCl, due to hexachlorocomplex formation. The dissolution process proceeds as $FeO.TiO_2 + 6HCl(aq) \rightleftharpoons FeCl_2(HCl, aq) + TiCl_4(HCl, aq) + 3H_2O$. 6 ref. (P12e; Ti)

93-P. (French.) **Electronic and Ionic Properties of Transition Metals.** Andre Roos. *Chimie et Industrie,* v. 76, Nov. 1956, p. 1032-1046.

Electronic theory of metals: ionization, ferromagnetic phenomena, magnetostriction, lattice-distortion theory, magnetic transformation temperature, atomic and ionic diffusion and magnetic aging. Describes experimental study of anodic oxidation making it possible to measure the "ionic diffusion coefficient" of metals by a new method, based on the continuous measure of the thickness of oxide film by means of a photoelectric cell. (P15, P16)

94-P. (French.) **Study of the Ternary Alloys Palladium-Nickel-Copper.** Joseph Cohen. *Comptes Rendus,* v. 245, Dec. 5, 1956, p. 1845-1847.

Magnetic transformation temperature and magnetic properties of palladium-nickel-copper. 5 ref. (P16; Pd, Ni, Cu)

95-P. X-Ray and Magnetic Study of Nickel Selenides in the Range NiSe to $NiSe_2$. Fredrich Gronvold and Einar Jacobsen. *Acta Chemica Scandinavia,* v. 10, no. 9, 1956, p. 1440-1454.

Two nickel selenide phases are identified in the range of NiSe to $NiSe_2$ by means of X-rays. Results of X-ray study, density measurements and magnetic properties. 32 ref. (P16; Ni, *Se*)

96-P. Use of Sodium and Sodium-Potassium Alloy as a Heat-Transfer Medium. W. B. Hall and T. I. M. Crofts. *Institute of Mechanical Engineers, Proceedings,* v. 170, no. 10, 1956, p. 321-339.

The applications of liquid metals in heat-transfer problems. Comparisons are drawn between those metals whose melting points are sufficiently low to make them of interest in this respect. Design and construction of liquid metal circuits and the components which are commonly used in them are given. 13 ref. (P11k; SGA-d, 14-10)

97-P. Electrical Resistance of Thin Metal Films Before and After Artificial Aging by Heating. Richard B. Belser. *Journal of Applied Physics,* v. 28, Jan. 1957, p. 109-116.

Measurement of electrical resistances of thin films of 24 metals, deposited on glass substrates (near room temperature) by evaporation, sputtering or electroplating before and after artificial aging by heating in vacuo. (P15g, 2-15; 14-12)

98-P. Interface Energy Studies of Some Copper-Tin Alloys Containing a Liquid Phase. A. A. Krishnan and B. Halder. *Journal of Scientific and Industrial Research,* v. 15B, Dec. 1956, p. 676-681.

The influence of successive additions of tin to copper on the dihedral angle of alpha bronze vs. liquid phase like lead and bismuth. The effect of temperature on the dihedral angle and hence on the relative interface energies is reported. 4 ref. (P13h, 1-11; Cu, Sn)

99-P. Metals That Flow. Sanford C. Cohen. *Northwestern Engineer,* v. 16, Feb. 1957, p. 30-31, 52.

The unusual properties of liquid metals offer solutions to some of the more difficult heat transfer problems. (P12k; 14-10)

100-P. An Analysis of Magnetization Processes in Iron Single Crystals by an Electrical Method. R. Parker. *Philosophical Magazine,* v. 1, 8th series, Dec. 1956, p. 1133-1146.

Doring's theory of anisotropy of electrical resistivity of ferromagnetics is applied to published magnetoresistance data of single crystals of iron. The five anisotropy coefficients for iron are evaluated. (P16, P15g; Fe, 14-11)

101-P. Ferromagnetic Resonance in Metal Single Crystals. J. O. Artman. *Physical Review,* v. 105, Jan. 1, 1957, p. 74-84.

Microwave susceptibility expressions for ferromagnetic resonance for metal single crystals possessing crystalline anisotropy. Crystals of uniaxial and cubic magnetic symmetry are considered. (P16; 14-11)

102-P. Structure of the Intermediate State in Superconducting Lead. P. B. Alers. *Physical Review,* v. 105, Jan. 1, 1957, p. 104-108.

The Faraday effect in a cerous nitrate-glycerol mixture was used to study the structure of the intermediate state. Photographs showing the distribution of normal and superconducting material at various magnetic fields. A lead alloy containing antimony and tin was used as a specimen. (P15g, P16; Pb)

103-P. Thermal Expansion of Rare Earth Metals. F. Barson, S. Legvold and F. H. Spedding. *Physical Review,* v. 105, Jan. 15, 1957, p. 418-424. (CMA)

The thermal expansion of lanthanum, cerium, praseodymium, neodymium, gadolinium, terbium, dysprosium, europium and ytterbium measured from 25 to 900° C. The first four show plastic flow properties below their melting points; praseodymium, neodymium and ytterbium have high-temperature phase transformations, gadolinium, terbium and dysprosium have negative coefficients of expansion, and that of ytterbium is three times those of the others. 29 ref. (P11g; EG-g)

104-P. Hall Effect and Resistance of Dilute Gold-Chromium Alloys at Low Temperatures. Werner B. Teutsch and William F. Lowe. *Physical Review,* v. 105, Jan. 15, 1957, p. 487-490.

The temperature dependence of the Hall effect and of the electrical resistance in pure gold and in gold containing 0.03 and 0.05 at.% chromium, principally at temperatures in the liquid helium region. For these compositions the temperature dependence of the resistance is abnormal at low temperatures, exhibiting a resistance minimum. (P15g, 2-13; Au, Cr)

105-P. Carrier Lifetime in Semiconductors for Transient Conditions. D. J. Sandiford. *Physical Review,* v. 105, Jan. 15, 1957, p. 524.

On the basis of the trap model the solution is given for the transient recombination of holes and electrons in semiconductors such as encountered in photoconductive decay experiments. (P18g)

106-P. Temperature Dependence of Piezoresistance of High-Purity Silicon and Germanium. F. J. Morin, T. H. Geballe and C. Herring. *Physical Review,* v. 105, Jan. 1957, p. 525-539.

The change of resistance in uniaxial compression has been measured for a number of single-crystal specimens of high-resistivity n and p-type germanium and silicon over the ranges 5° to 350° K. (germanium) and 20° to 350° K. (silicon). 16 ref. (P15g, 2-11; Si, Ge)

107-P. Neutron Transmission Measurements and Resonance Parameters in Cadmium. F. B. Simpson and R. G. Fluharty. *Physical Review,* v. 105, Jan. 15, 1957, p. 616-619.

Neutron transmission measurements for cadmium from 14.5 electron volts to 11 kilo-electron volts. Isotropic assignments have been made to those resonances which are due to cadmium^{111} and cadmium^{113} by using a sample enriched in cadmium^{111} and another sample depleted in cadmium^{113}. 12 ref. (P18m; Cd)

108-P. A Comparison of Magnetic Viscosity and Anisotropic High Coercivity Alloys. R. Street and J. C. Wooley. *Proceedings of the Physical Society,* v. 69B, Dec. 1, 1956, p. 1189-1199.

Measurements of magnetic viscosity in equiaxed isotropic and anisotropic Alcomax III specimens; the anisotropy was introduced by cooling the material from the single-phase region in a magnetic field of 4000 Oersteds. Results in terms of the concept of the thermal activations of irreversible domain boundary wall movements. 11 ref. (P16; SGA-n)

109-P. Magneto-Thermal Effects in Nickel and Cobalt. R. S. Tebble and R. W. Teale. *Physical Society, Proceedings, Section B,* v. 70, Jan. 1957, p. 51-64.

Comprehensive measurements on the reversible and total magneto-thermal effect, the reversible susceptibility and the magnetization curves of annealed nickel and cobalt. 11 ref. (P16; Ni, Co)

110-P. Magneto-Resistance Effects in the Group I Metals at High Fields. R. G. Chambers. *Royal Society Proceedings, Series A,* v. 238, Jan. 8, 1957, p. 344-357.

Measurements on the resistivity and Hall coefficient of pure specimens of copper, silver and gold at 4° K. in fields up to 25KG. The theoretical form of the conductivity tensor in high fields is worked out for arbitrary dependence of energy and relaxation time on wave-vector and is found to be in qualitative disagreement with the experimental results. 24 ref. (P16, P15g; Cu, Ag, Au)

111-P. Thermal Conductivity of Germanium and Silicon Between 2 and 300° K. J. A. Carruthers, H. M. Rosenberg, T. H. Geballe and J. M. Ziman. *Royal Society Proceedings, Series A,* v. 238, Jan. 29, 1957, p. 502-514.

The thermal conductivity of single crystals of pure n-type germanium and of p-type germanium containing from 10^{14} to 10^{19} group 3 impurity atoms per cc. has been measured from 2° to 90° K. In some cases the readings have been extended to room temperature. 27 ref. (P11h; Ge, Si)

112-P. Environment Barrier Plagues Supersonic Electric Equipment. Victor B. Hart. *Western Metals,* v. 15, Feb. 1957, p. 54-55.

Summarizes upper temperature limits for basic materials and electric components. (P15, 1-12, Ti)

113-P. The Dissociation Pressures of the Tantalum Silicides. Clifford E. Myers and Alan W. Searcy. *American Chemical Society, Journal,* v. 79, Feb. 5, 1957, p. 526-528.

The dissociation pressures of the tantalum silicides measured by Knudsen effusion method. Phase modifications in the temperature ranges covered were established by quenching experiments and X-ray diffraction investigation. (P12; Ta, Si)

114-P. Molybdenum Combats High Temperature. *Chemical Engineering,* v. 64, March 1957, p. 298, 300, 302, 304. (CMA)

Molybdenum is more advantageous to process engineers than are superalloys and ceramics, because of the variety of forms available. The modulus of elasticity, thermal conductivity, coefficient of thermal expansion, electrical conductivity, absorption cross section, hardness, creep-rupture and corrosion resistance are discussed. Molybdenum parts are available as spinnings, forgings and extrusions, or as drawn, machined, welded, brazed and riveted. Uses are described. (P general, Q general, 2-12, T general; Mo)

115-P. Supermendur—a New Rectangular-Loop Magnetic Material. H. L. B. Gould and D. H. Wenny. *Electrical Engineering,* v. 76, March 1957, p. 208-211. (CMA)

The magnetic and mechanical properties of a vanadium-iron-cobalt alloy discussed. Outstanding qualities are high remaneance and permeability and low hysteresis loss and coercive force. The hysteresis loop is rectangular. Melting, processing and heat treatment of the alloy described. The alloy should be very useful in power applications, miniaturization, telephone receivers, switches and refractory applications. (P16, A general, SGA-n)

116-P. Current Distribution in Galvanic Cells Involving Natural Convection. Carl Wagner. *Electrochemical Society, Journal,* v. 104, Jan. 1957, p. 129-131.

From equations for mass transfer due to natural convection in a laminar boundary layer, it is derived that, in electrolytic cells used for the refining of metals such as copper, the current density is virtually constant, although concentration polarization at both the cathode and the anode varies from bottom to top. 9 ref. (P15, C23p; Cu)

117-P. Influence of Impurities on the Photoconductance of Zinc Oxide. Harold A. Papazian, Paul A. Flinn and Dan Trivich. *Electrochemical So-*

ciety, Journal, v. 106, Feb. 1957, p. 84-92.

The photoconductance of pure zinc oxide and zinc oxide with known impurities, both in powder form, has been measured using a condenser method. When irradiated by light, zinc oxide undergoes a "memory mechanism" which depends on the past irradiation history. It is suggested that the memory is caused by the formation of traps independent of charge carrier formation. 23 ref. (P17c, 3-19; Zn, 14-18)

118-P. The Cohesive Energies of Transition Metals. J. Stanley Griffith. *Journal of Inorganic and Nuclear Chemistry,* v. 3, Aug. 1956, p. 15-23.

The cohesive energy is regarded as made up of just two parts, one arising from the breakdown of intra-atomic spin couplings and the other from the formation of interatomic ones. The former is calculated in terms of atomic spectral parameters and the latter is assumed to vary smoothly along the series with a maximum in middle. (P18)

119-P. Volume-Temperature Relationships in Magnesium Cadmium Alloys—I. Thermal Expansivities in the Order-Disorder Range. R. A. Flinn, W. E. Wallace and R. S. Craig. *Journal of Physical Chemistry,* v. 61, Feb. 1957, p. 234-236.

Thermal expansivities of magnesium chloride were measured to try to ascertain the factors responsible for the abundance of vacancies. The measurements were extended to the compositions MgCd and Mg_3Cd. There is good agreement between the present results and expansivities obtained by the X-ray method and volume expansivities computed from measured lines expansivities of bulk samples. (P10d, P12g; Mg, Cd)

120-P. Volume-Temperature Relationships in Magnesium-Cadmium Alloys.—II. Kinetics of the Order-Disorder Transformation in $MgCl_3$. R. A. Flinn, W. E. Wallace and R. S. Craig. *Journal of Physical Chemistry,* v. 61, Feb. 1957, p. 236-239.

The rates of ordering and disordering of magnesium cadmide have been determined by a dilatometric method. The transformation appears to occur in two stages both of which are, within the limit of error, first order processes. Rate constants at a number of temperatures are presented. (P10d, N10a; Mg, Cd)

121-P. The Existence of Microcracks After Cold-Work. A. N. Stroh. *Philosophical Magazine,* v. 2, Series 8, Jan. 1957, p. 1-4.

It is suggested that changes in density and electrical resistance on cold work may be due to the formation of microcracks. To fit the experimental values of Clarebrough, et al., 8 x 10^4 cracks per square centimeter are needed, each 1.3 x 10^{-3} centimeters in length.
(P10a, P15g, Q26p, 3-18)

122-P. Magneto-Resistance in Metals. D. K. C. MacDonald. *Philosophical Magazine,* v. 2, Series 8, Jan. 1957, p. 97-104.

Magneto-resistance of sodium and rubidium. Measurements have been made both on plate-like specimens which show very strong anisotropy in the magnetic field, and on a cylinder of diameter large compared with the mean free path of the electrons. (P16; Na, Rb)

123-P. Ferromagnetic Resonance in Thin Films of Permalloy. P. E. Tannewald and M. H. Seavery. *Physical Review,* v. 105, Jan. 15, 1957, p. 337-378.

Microwave resonance measurements have been made in evaporated 82% Ni, 18% Fe films 760 to 1600 thick. The longest relaxation, as measured by the line width, gives relaxation time, $T_2 = 3 \times 10^{-3}$ sec. The sample thickness was equal to or less tnan the skin depth, resulting in a Lorentzian-type line. Multiple resonances were obtained according to shape anisotropy theory. (P16; Ni, Fe, SGA-n, 14-12)

124-P. Effects of Thick Oxides on Germanium Surface Properties. M. Lasser, C. Wysocki and B. Bernstein. *Physical Review,* v. 105, Jan. 15, 1957, p. 491-494.

Oxides grown on germanium by heating in oxygen are shown to inhibit interaction between the germanium and the ambient atmosphere. The decay time of the direct current field effect increases with increasing thickness of the oxide formed. The decay time decreases in the presence of water vapor, iodine, or ammonia in the ambient. The surface underneath a thick oxide is shown to be strongly n type and has a low value of surface recombination velocity.
(P13, P15; Ge)

125-P. Hall and Drift Mobility in High-Resistivity Single-Crystal Silicon. Donald C. Cronemeyer. *Physical Review,* v. 105, Jan. 15, 1957, p. 522-523.

Room-temperature Hall and drift mobilities for samples of single-crystal silicon ranging in resistivity from about 10^{-2} ohm centimeters to nearly intrinsic. 10 ref. (P15p; Si, 14-11)

126-P. The Characterization and Crystal Structure of Caesium Antimonide, a Photo-Electric Surface Material. K. H. Jack and M. M. Wachtel. *Royal Society, Proceedings,* v. 239A, Feb. 12, 1957, p. 48-60.

Although caesium antimonide is the most efficient photo-emitter known, no adequate explanation has been offered for its unique properties. The present X-ray investigation shows that it is a normal valency intermetallic compound with a small range of homogeneity near to the composition Cs_3Sb. 34 ref.
(P15k, M26q; Cs, Sb)

127-P. (German.) The Reflection of Ions and the Secondary Electron Emission on Alkali Ion Bombardment of Surfaces of Pure Molybdenum. Curt Brunnée. *Zeitschrift fuer Physik,* v. 147, no. 2, 1957, p. 161-183. (CMA)

The reflection of ions and the secondary electron emission of pure molybdenum surfaces bombarded with alkali ions were studied with the 60° mass spectrometer. The results indicate that the reflection of ions occurs by isotropic multiple back scattering and that the ions produce secondary electron emission in the metal by ionization processes corresponding to their energy and direction distribution. 95 ref.
(P15k, 1-4; Mo-a)

128-P. (Hungarian.) Reduction of Titanium, Vanadium and Tungsten Oxides. Aurél Horvah. *Kohászati Lapok,* v. 11, no. 11-12, 1956, p. 497-505. (CMA)

The thermodynamic potential (ΔG_T) of titanium, vanadium and tungsten oxides can be calculated from basic thermodynamic data. The intersection of the function $\Delta G_T = \psi(T)$ for the oxides and for the reducing agents indicates the starting temperature of the reduction. The curves also indicate which oxides can be reduced directly or indirectly in the liquid and solid phases. From the relation between the oxygen absorbability of the liquid metal, their partial molar and integral thermodynamic potential and the oxygen mole fractions ($\Delta G_{o2} = \psi(x_o)$), it was deduced that a reducing agent is not necessarily suitable for the production of the metal only because its oxygen affinity is larger than that of the metal, mainly because the oxygen absorbability increases so tremendously in the metallic phase. 4 refs.
(P12, N16m; Ti, V, W, 14-18)

129-P. Studies Relating to the Reaction Between Zirconium and Water at High Temperatures. A. W. Lemmon, Jr. Battelle Memorial Institute. *U.S. Atomic Energy Commission,* BMI-1154, Jan. 3, 1957, 114 p. (CMA)

Data are reported from studies of the reaction rate between solid and molten Zircaloy and steam, the spectral and total emissivity of Zircaloy and its oxide, and the rate of oxygen diffusion into Zircaloy. Part of the reaction rate study covered the amount of reaction expected for a molten drop of Zircaloy falling through water; temperature variations around the drop were considered by use of a theoretical model. (P13b, 2-12, R11d; Zr)

130-P. Magnetic Properties of Holmium and Thulium. B. L. Rhodes, Sam Legvold and F. H. Spedding. Iowa State College, *U.S. Atomic Energy Commission,* ISC-701, Dec. 1955, 58 p. (CMA)

Measurement of the antiferromagnetic and paramagnetic properties of holmium and thulium shows that both have these kinds of behavior in different temperature regions. Values of the magnetic moment were observed that exceeded the spin-only contribution. Temperatures below the Néel point were obtained for thulium. 35 ref.
(P16; Ho, Tm)

131-P. Electrical Properties of Magnesium Silicide and Magnesium Germanide. Charles R. Whitsett and G. C. Danielson. Iowa State College, *U.S. Atomic Energy Commission,* ISC-714, July 1955, 81 p.

Single crystals of magnesium silicide and magnesium germanide, of high purity, were obtained, and measurements were made of their electrical resistivities and Hall coefficients in temperature range 60-1000° K. 63 ref.
(P15g; Mg, Si, Ge, 14-18)

132-P. Anomalous Electron Emission From Metallic Surfaces. F. R. Brotzen. (Naval Research Laboratory) *U.S. Office of Technical Services,* PB 111938, Sept. 1956, 12 p. $.50.

Heating and cooling tests on low-melting abraded metals and alloys were undertaken in an effort to determine why electrons are irregularly emitted from the metal surfaces at temperatures below those characteristic of thermionic emission. The solidification of tin, bismuth and cadmium was found to be associated with an anomalously high emission rate. Lead, lead-tin alloys and a cadmium-tin alloy had no emission peaks during solidification.
(P15k, N12; Sn, Bi, Cd, Pb)

133-P. Fundamental Properties of Metal-Ceramics Mixtures at High Temperatures. Alfred University (Office of Naval Research). *U.S. Office of Technical Services,* PB 121413, Jan. 1955, 103 p. $2.75.

High-stress high-temperature applications conducted for the Navy are summarized in a final report. New compositions were formulated

from mixtures of metals and oxides and from lesser known metalloid and intermetallic compounds. Evaluation methods and criteria were established and theoretical concepts were developed to explain observed behavior in the new metal-ceramics mixtures.
(P general, Q general; 6-20)

134-P. Magnetic Properties of 6.4 Percent Silicon-Iron Sheet Material. J. F. Nachman and W. J. Buehler. (U.S. Naval Ordnance Laboratory.) *U.S. Office of Technical Services,* PB 121545, May 1956, 20 p. $.50.

A silicon-iron alloy which showed promise for synchro, transformer and magnetic amplifier applications was produced and evaluated.
(P16; Fe, *Si*)

135-P. (Report.) **The Distribution of Plutonium and Fission Products Between Molten Uranium and Molten Uranium Trifluoride—Barium Halide Mixtures.** F. S. Martin and E. W. Hooper. *British Atomic Energy Research Establishment,* A.E.R.E. C/R 2083, 1956, 106 p.

The distribution of plutonium between molten uranium and mixture of uranium trifluoride with barium chloride or fluoride has been measured at temperatures of 1200-1400° C. The equilibrium constant for the reaction $Pu - UF_3 \rightleftharpoons PuF_3 + U_{16}$ found to be 72 + 50% calculated on a mole fraction basis. 11 ref.
(P12d; Pu, U)

136-P. (Book.) **Principles of Engineering Heat Transfer.** Warren H. Giedt. 372 p., 1957. D. Van Nostrand Co., Inc., 257 Fourth Ave., New York 10, N. Y. $8.25.

A text for college engineers of junior level. Over-all picture of energy transfer is discussed. Conduction, convection and radiation are studied separately. Coverage on fluid flow is similar to that presented in undergraduate courses in fluid mechanics and is included preparatory to the study on convection. Physical interpretation as well as extensive analytical material is included. (P11)

Mechanical Properties and Tests

299-Q. Prediction of Twinning Modes in Metal Crystals. M. A. Jaswon and D. B. Dove. *Acta Crystallographica,* v. 10, Jan. 10, 1957, p. 14-18.

New method of crystallographic analysis of deformation twinning in multiple lattices. This enables the operative twinning modes to be predicted for all metal crystals, including alpha-uranium. Reasons for the nonappearance of certain modes expected theoretically. (Q24b, M26)

300-Q. Effects of Grain Boundaries on the Plastic Deformation of Zinc Crystals. G. B. Craig and B. Chalmers. *Canadian Journal of Physics,* v. 35, Jan. 1957, p. 38-47.

Investigations of tensile plastic deformation of single-crystal and tricrystal specimens of zinc by analysis of the external change and of the change in X-ray diffraction pattern. (Q24; Zn)

301-Q. Some Aspects of the Plastic Design of Aluminum Structures. S. K. Ghaswala. *International Association for Bridge and Structural Engineers, Publications,* v. 16, 1956, p. 231-254.

Evaluation of the theories of plasticity in designing aluminum structures; survey of fields of bending, torsion, inelastic stability, plate stability, compression and frameworks; recent ideas on strength in terms of cohesive slip and cohesive resistance. 94 ref.
(Q general, T26, 17-1; Al)

302-Q. Mechanical Properties of Flake Graphite Cast Irons. G. N. J. Gilbert. *Iron and Steel,* v. 30, Feb. 1957, p. 45-51.

Modulus of elasticity, Brinell hardness, general relationship between chemical composition, cooling rate and mechanical properties. 41 ref.
(Q21a, Q29n; CI)

303-Q. Properties of Materials at Very High Temperatures. *Materials and Metnods,* v. 45, no. 2, Feb. 1957, p. 151, 153. (CMA)

Short-time tensile, creep and fracture properties at high temperatures and rapid rates of loading were studied for molybdenum, copper, iron, tantalum and graphite. At equal temperatures molybdenum and tantalum are better than iron or copper, but are subject to oxidative attack.
(Q26, Q27a, Q3m, 2-12; Mo, Cu, Fe, Ta, C)

304-Q. Molybdenum as an Alloy Addition for Titanium. H. Margolin. *Metal Progress,* v. 71, Feb. 1957, p. 86-91. (CMA)

Alpha and beta alloying additions for titanium are discussed generally. Ti-Al alloys have low strength at intermediate temperatures and therefore aluminum is used as an α stabilizer in α-β alloys, thus contributing to the high-temperature strength. Iron and chromium form compounds and, if present, must be offset by molybdenum, vanadium or manganese. A Ti-7Al-3Mo alloy was studied; its creep strength is better than that of Ti-6Al-4V, and the strength-weight ratio is superior to that of all competitors. The aswelded sheet is brittle and sheet forming appears to be difficult. Adding zirconium or tin is beneficial. Hardenability of titanium alloys is discussed. Molybdenum leads to greater tolerance of hydrogen.
(Q general, 2-10; Ti, *Mo*)

305-Q. Possible Mechanism for the Fracture of Metals. Eiichi Fujita. *Physical Society of Japan, Journal,* v. 11, Nov. 1956, p. 1201.

Theoretical consideration of Griffith crack. 6 ref. (Q26)

306-Q. Nitrogen Improves Valve Steel. *Steel,* v. 140, Feb. 18, 1957, p. 169-172.

Tensile data analysis and valve life for new high-nitrogen autenitic steel (21-4N).
(Q27a, T7; SS-e, *N*)

307-Q. Buckling Limits in Contour Forming. Part I. William W. Wood. *Tool Engineer,* v. 38, Feb. 1957, p. 85-91.

Factors which lead to buckling and formability indexes for a number of materials used in aircraft design. (Q28g, Q23q, G9)

308-Q. Spring Back of Metals. F. J. Gardiner. *Transactions of the ASME,* v. 79, Jan. 1957, p. 1-9.

A generalized and simplified mathematical analysis and derivation for springback correction curves for pure bending. (Q5)

309-Q. On the Applicability of Notch Tensile Test Data to Strength Criteria in Engineering Design. J. D. Lubahn. *Transactions of the ASME,* v. 79, Jan. 1957, p. 111-115.

Current applicability of notch-test results to engineering problems, importance of stress calculations to engineering design, problems of developing a design procedure for prevention of fracturing. 18 ref.
(Q27d, 17-1)

310-Q. Creep Damage in a Cr-Mo-V Steel as Measured by Retained Stress-Rupture Properties. M. H. Jones, D. P. Newman and W. F. Brown. *Transactions of the ASME,* v. 79, Jan. 1957, p. 117-120.

Deterioration during creep at 1000° F. measured by the retained 1100° F. stress-rupture properties. Mathematical procedure, results, mechanism of damages. 12 ref.
(Q3m; AY)

311-Q. Residual Stress in Cold Extruded Aluminum. J. Frisch and E. G. Thomsen. *Transactions of the ASME,* v. 79, Jan. 1957, p. 155-160.

A 1.5-in. diameter cylindrical bar was extruded at room temperature from an 1100-0 (25-0) aluminum diameter billet, 4.3 in. Residual stresses determined from the axially relaxed stresses in the billet during extruding. 6 ref. (Q25h, G5; Al)

312-Q. Effect of Frequency and Temperature on Fatigue of Metals. S. R. Valuri. *U.S. National Advisory Committee for Aeronautics. Technical Note* 3972, Feb. 1957, 15 p.

Fatigue problem from viewpoint of two-component system. (Q7, 2-11)

313-Q. (English.) **Creep of Low-Carbon Steel Under Interrupted Stressing.** Tosho Nishimura, Shuji Taira, Kichinosuke Tanaka and Kyotsugu Ohji. *Kyoto Daigaku Kenkyushyo Kenkyu Hokoku,* v. 6, Oct. 1956, p. 127-145.

Results of constant stress tests and creep tests under interrupted stressing. Theoretical consideration and discussion. 24 ref.
(Q3r, Q3s; CN-g)

314-Q. (French.) **Special Cast Irons and Their Applications in the Mineral Industry.** G. Henon. *Revue Générale de Mécanique,* no. 95, Dec. 1956, p. 407-413.

The general and mechanical characteristics of various types of cast iron. Applications in the mineral and hydraulics industries.
(Q general, W15, 17-7; CI)

315-Q. (Japanese.) **Creep of Mild Steel.** Toshio Mishihara, Shuji Taira and Kichinosuke Tanaka. *Kyoto Daigaku Kenkyushyo Kenkyu Hakoku,* v. 6, Aug. 1956, p. 99-125.

Creep behavior under constant tensile stress. By the rheological analysis of the creep strain, a formula which represents stress-strain-time relation was introduced. By using the formula, tension test results, bending creep test results and creep test results under combined stress are interrelated with the data of tension creep test. 9 ref.
(Q3r; CN)

316-Q. (Japanese.) **Bearing Steel Manufactured by Acid Openhearth and Basic Electric Furnace.** Ueno. *Nippon Kikai Gakaishi,* v. 59, Dec. 1956, p. 891-897.

Chemical composition of nonmetallic inclusions; mechanical properties of the bearing steel. 8 ref.
(Q general; ST-e, ST-f, SGA-c)

317-Q. (Japanese.) **On the Changes of Mechanical Properties and Microstructures of Commercially Pure Titanium Sheets by Cold Rolling and Annealing.** Yutaka Kondo. *Sumitomo Metals,* v. 8, Oct. 1956, p. 201-220.

Experimental studies on the changes of mechanical properties

and microstructures of various commercial titanium sheets by cold rolling and annealing. 28 ref.
(Q general, M27a; 2-14, 3-18; Ti, 4-3)

318-Q. (Japanese.) Effects of Titanium on the Properties of Binary Cu Alloys. Rihei Kawachi. *Sumitomo Metals,* v. 8, Oct. 1956, p. 229-235.

Microstructure and hardness in cast, annealed, quenched and cold worked states. (Q29n, M27; Cu, Ti)

319-Q. (Russian.) Instrument for Determining the Hardness of Aircraft Engine Cylinder Walls. M. M. Khruschev, Ye.S. Berkovich and M. D. Krashchin. *Priebery i Stendy,* no. P-564-460, 1956, p. 3-7.

The microscope of the ImASh (Institute of Machine Science) has but one 40× lens. The diagonals of the diamond-made indentations are measured with the 10× ocular micrometer AM9-1. Loads of 100 and 200 g. are used in the ImASh instrument. (Q29q; 1-2)

320-Q. Dislocation Theory of Plastic Bending. W. T. Read, Jr. *Acta Metallurgica,* v. 5, Feb. 1957, p. 83-88.

The macroscopic stress (average stress in a volume containing many dislocations) in a uniformly bent crystal is related to the dislocation density by a simple differential equation analogous to Poisson's equation. Differences between bending and tension tests give information about the dislocation mechanism of deformation. (Q24f, Q27, Q5, 1-4)

321-Q. The Yield Strength of Partly Ordered F.C.C. Structures. H. J. Logie. *Acta Metallurgica,* v. 5, Feb. 1957, p. 106-109.

Partly ordered alloys (of face-centered cubic structures) show a dependence of yield strength on the size of the ordered domains. By considering the increase in disorder as slip progresses, a value for the yield strength is obtained in terms of the domain size which is in good agreement with experimental values. (Q23b, N10)

322-Q. Flexibility of Thin Porcelain Enameled Sheet Steel. A. G. Eubanks, J. R. Crandal and J. C. Richmond. *American Ceramic Society, Bulletin,* v. 36, Feb. 1957, p. 59-63.

Low-carbon steel strips of 0.004, 0.007 and 0.010-in. thickness were given porcelain enamel applications ranging from 0.0017 to 0.0063 in. thick, deformed around cylindrical blocks of various radii of curvatures and inspected to determine if failure of the enamel by cracking had occurred. It was found that the failure radius ranged from 1½ to 4 in., depending upon the thickness of the enameled strip, the thicker strips failing at larger ratio.
(Q5g; ST, 8-21, 4-3)

323-Q. Effect of Stress on Creep at High Temperatures. H. Lakes, C. D. Wiseman, U. D. Sherby and J. E. Dorn. *American Society of Mechanical Engineers,* Preprint no. 56-A-55, Nov. 1956, 7 p.

Experimental investigation on pure aluminum and its dilute solution alloys revealed that the high-temperature creep rate is related to the stress. According to a preliminary dislocation-climb model for high-temperature creep, the activation energy for creep is that for self-diffusion and the effects of stress on the creep rate depend on the number of active Frank-Reed sources, and the rate of climb depends on the structure as determined by the pattern of climbing dislocations. 14 ref.
(Q3m, 2-12, 3-16; Al)

324-Q. Fatigue of Metals Under Combinations of Stress. W. N. Findley. *American Society of Mechanical Engineers,* Preprint no. 56-A-74, Jan. 10, 1957, 11 p.

Analysis of available information suggests that the phenomenon of fatigue of materials results primarily from alternating stress producing cracks along shear planes, and that the resistance to fatigue cracking is influenced by other factors. Some of these factors are changes in structure of the material resulting from plastic and elastic stressing as well as heat treatment. (Q7)

325-Q. Delayed-Yield Time Effects in Mild Steel Under Oscillatory Axial Loads. R. O. Belsheim. *American Society of Mechanical Engineers,* Preprint no. 56-A-108, Nov. 1956, 7 p.

An apparatus was developed which loads a tension specimen by a vibratory load superimposed on a static load. Tests of mild steel produced (a) dynamic yield points 5 to 50% above the static yield point, and (b) corresponding delayed-yield time of 1000 to 10 milliseconds. 23 ref.
(Q23b, 1-2; CN)

326-Q. The Flow and Fracture of Nodular Cast Iron. W. R. Clouch and M. E. Shank. *American Society of Mechanical Engineers,* Preprint no. 56-A-110, Nov. 1956.

The phenomenon of fatigue of materials results primarily from alternating shearing stress producing cracks along shear planes. The resistance to fatigue cracking is influenced by various factors. Some of these factors are changes in structure of the material resulting from plastic and elastic stressing and heat treatment. 23 ref. (Q7; CI-r)

327-Q. Chromium-Molybdenum and Chromium - Molybdenum - Vanadium Steels for Power Plant and Refinery Service up to 1100° F. George V. Smith. *American Society of Mechanical Engineers,* Preprint no. 56-A-214, Nov. 1956, 32 p.

Effects of composition and heat treatment on strength; introduction of other properties such as creep, structural stability, stress at various temperatures; fabrication characteristics. 76 ref.
(Q general, 2-12, W11, 17-7; AY)

328-Q. Austenitic Steels in High Temperature Steam Piping. R. M. Curren and A. W. Ranlun. *American Society of Mechanical Engineers,* Preprint no. 56-A-217, Nov. 1956, 16 p.

Review of high-temperature properties of the available steels. Cracking occurring in and adjacent to welded joints in austenitic steels has deterred more widespread application. Suggestions for minimizing difficulties encountered with austenitic piping materials are given. 5 ref.
(Q general, 2-12, 9-22, W10; SS-e)

329-Q. High Temperature Magnesium for Supersonic Aircraft. *Automotive Industries,* v. 116, Feb. 15, 1957, p. 66-69.

Magnesium-thorium alloys for light-weight, high-temperature requirements for supersonic structural airframe components. Mechanical properties of magnesium-thorium alloys, HK31A and HM21XA-T8, have been investigated.
(Q general, 2-12, T24; Mg, SGB-s)

330-Q. A Preliminary Study of Three Cermets Based on Uranium Oxide. L. S. Williams, D. T. Livey and R. Murry. *British Atomic Energy Research Establishments,* A.E.R.E. M/R 1934, 1956, 26 p.

The fabrication and some properties of three cermets investigated in outline. The thermal shock properties of uranium oxide are not improved by the addition of zirconium. The use of silicon as the metallic constituent at 20% by volume improves the oxidation resistance of uranium oxide in air at temperatures up to 900° C. 11 ref.
(Q10a, R1h; U, Zr, 6-20)

331-Q. Tensile Fracture of Ductile Metals. H. H. Bleakney. *Canadian Metals,* v. 20, Feb. 1957, p. 60-64.

Tension tests of aluminum and heat treated mild steel revealed three modes of fracture; fracture with 100% reduction of area and fracture with slowly or rapidly growing features. Data suggested that true stress at fracture is not experimentally determinable by methods presently known. 7 ref.
(Q26r, Q27a; Al, CN)

332-Q. Wear Protection of Mild Steel by Phosphating. J. W. Midgley. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 215-227.

A study is made by microscopy of the change in the nature of mild steel surfaces phosphated in an accelerated iron phosphate, or an accelerated iron manganese phosphate bath, and of the changes during subsequent wear tests. 23 ref.
(Q9n, L14b; CN)

333-Q. Properties of Materials at Very High Temperatures. J. R. Kattus. *Materials and Methods,* v. 45, Feb. 1957, p. 151-153.

Comparison of tensile strength, modulus of elasticity, yield strength and elongation at high temperatures for molybdenum, tantalum, iron, copper and graphite.
(Q27a, Q21a, Q23b, 2-12; Mo, Ta, Fe, Cu, NM-k36)

334-Q. Metallurgical Yield-Stress Observation. Joseph William Jacobson. *Mechanical Engineering,* v. 79, Jan. 1957, p. 13-15.

Use of metallography in the study of mechanism of failure within the grain structure. Results are presented in the form of micrographs, giving a visible reproduction of materials under load. (Q23b, M21)

335-Q. Improved Silicon Carbide. *Mechanical World and Engineering Record,* v. 137, Feb. 1957, p. 59.

New material possessing higher flexural strength, higher stiffness, lower permeability, better thermal properties and higher abrasive resistance than conventional silicon carbide. Silicon carbide itself is used as the bonding material.
(Q general, P11; Si)

336-Q. Influence of Temperature on Metallic Wear. J. K. Lancaster. *Physical Society Proceedings, Section B,* v. 70, Jan. 1, 1957, p. 112-118.

The influence of temperature on the wear rate of 60-40 brass on toolsteel has been investigated over the range 20 to 600° C. Two regimes of wear were found. At low temperatures, extensive intermetallic contact and welding occur, and the wear rate increases with increasing temperatures. At high temperatures the wear rate decreases by several orders of magnitude and protective surface films are generated during sliding. 8 ref. (Q9n, 2-11; Cu-n, TS)

337-Q. On the Mechanism of High-Temperature Creep in Metals With Special Reference to Polycrystalline Lead. P. Feltham. *Proceedings of the Physical Society,* v. 69B, Dec. 1, 1956, p. 1173-1188.

On the basis of Mott's suggestions that intracrystalline deformation in creep takes place by fine slip, and that the activation energy is that for the formation of screw dislocations impeded by jogs, expression for the high-temperature transient and equilibrium creep rate are given in terms of applied stress, temperature, the grain size and the characteristics of the intragranular substructure. 31 ref. (Q3m, 2-12; Pb)

338-Q. An Examination of a Mild Wear Process. J. F. Archard and W. Hirst. *Royal Society, Proceedings,* Series A, v. 238, Jan. 29, 1957, p. 515-528.

A detailed study of the wear of hardened high speed toolsteel rubbing on itself at a speed of 66 cms. under loads of a few kilograms. Radioactive tracers, optical microscopy, reflection and replica electron microscopy, and other methods of surface examination have been used. 13 ref. (Q9n, 1-4; TS-m)

339-Q. Effect of a Tangential Force on the Contact of Metallic Bodies. J. S. Courtney-Pratt and E. Eisner. *Royal Society, Proceedings* Series A, v. 238, Jan. 29, 1957, p. 529-550.

Examination of the tangential movement of two bodies relative to each other and the size of the area of contact between them, when they are first loaded normally and then subjected to tangential forces too small to cause sliding. Investigation of the contact of like metallic specimens, using gold, platinum, tin, indium and mild steel. 36 ref. (Q9p; Au, Pt, Zn, In, CN)

340-Q. Buckling Limits in Contour Forming, Part II. William W. Wood. *Tool Engineer,* v. 38, Mar. 1957, p. 105-113.

Plate buckling is the primary cause of failure when forming curved flanges. The author has developed formability limit curves which make it possible to predict whether a curved flange can be formed without buckling. Other forming limits are also covered. (Q28g, Q23q, G9)

341-Q. Cast Copper Anti-Friction Steel. A. A. Lunev. University of Alabama (U.S. Bureau of Ships) U.S. Office of Technical Services, P.B. 121364, Jan. 1955, 15 p. (Translation from *Liteinoe Proizvodstvo.*)

Previously abstracted from original. See item 650-Q, 1955.

342-Q. (English.) **Internal Friction Due to Water in Copper.** Shosuke Imoto and Genjivo Mima. *Osaka University, Technology Reports,* v. 6, Mar. 1956, p. 141-144.

A copper polycrystalline specimen which contained 0.2% oxygen was heated in a hydrogen atmosphere till it no longer absorbed hydrogen. The internal friction was measured on this specimen under gradually increasing temperature from −10° C. Then a peak appeared on the internal friction vs. temperature curve near 0 °C. (Q22, 1-14; Cu)

343-Q. (French.) **Influence of the Nature of the Mold on the Mechanical Characteristics of Nonalloyed Gray Cast Iron.** Michel Ferry. *Fonderie,* no. 132, Jan. 1957, p. 15-23.

Comparative study of the mechanical properties (such as modulus of elasticity and Brinell hardness) of rough-cast bars with bars heat treated to form a ferritic structure in order to determine the respective roles played by the mold and by graphite. 5 ref. (Q1a, Q29n, W19; CI-n)

344-Q. (Russian.) **High Heat Stable Indentors for Measuring the Hardness of Metals When Heated to 1300° in a Vacuum.** M. G. Lozinskiy and M. B. Guterman. *Zavodskaya Laboratoriya,* v. 22, no. 11, 1956, p. 1358-1363.

For extending the temperature range of the tests and increasing the longevity of the indentor tips it was necessary to find new materials capable of replacing the technical diamonds being used. As the result of many comparative tests, synthetic corundum (artificial sapphire) tips were found to be most suitable for measuring alloy hardness at temperatures up to 1300°, under vacuum. (Q29b, 2-12, 1-23)

345-Q. Formability Index Determines Minimum Bend Radius. William W. Wood. *American Machinist,* v. 101, Feb. 25, 1957, p. 121-125.

Need for method for finding minimum bend radius of various sheet metal materials led to development of a formability index (true strain/average tensile yield strength). Use of formability index in nomograph allows direct determination of minimum bend radius. Results indicate present manufacturers' standards are too conservative. (Q23q, G6)

346-Q. Today's Frontiers in High Temperature Technology. N. K. Hiester, F. A. Ferguson and N. Fishman. *Chemical Engineering,* v. 64, Mar. 1957, p. 237-252.

Obtaining high temperatures by electrothermal, metallurgical and combustion processes, chemical and impulse methods, radiation and nuclear reactors. Materials which have high resistance to temperature, such as metals, metallic compounds and cermets are considered. (Q general, 2-12; SGA-h)

347-Q. Magnesium-Thorium Alloys. Donald Mathews. *Magnesium,* Feb. 1957, p. 4-7; disc., p. 10-16.

Evaluation of magnesium-thorium alloys for use in short-time guided missiles, including HK31 and AZ31 sheet, HK31 and HZ32 sand castings. Temperature, stiffness and resistance to buckling are considered in connection with minimum weight. Need for an improved die-casting alloy is discussed. (Q28g, 2-12, T2; Mg, Th)

348-Q. On the Mechanism of Work Hardening in Face Centered Cubic Metals With Special Reference to Polycrystalline Copper. P. Feltham and J. D. Meakin. *Philosophical Magazine,* v. 2, Series 8, Jan. 1957, p. 105-112.

Tensile specimens of oxygen-free polycrystalline copper (99.991%) were annealed for various periods in vacuo, in the range 500-700° C. so as to obtain variations in the grain sizes and yield points. 8 ref. (Q23a, J23; Cu)

349-Q. The Nature of Persistent Slip Bands in Fatigued Copper. D. S. Kemsley. *Philosophical Magazine,* v. 2, Series 8, Jan. 1957, p. 131-132.

Evidence of the nature of persistent slip bands obtained during metallographic work on rotating cantilever fatigue specimens of annealed high-conductivity copper. (Q24a, Q7; Cu)

350-Q. (German.) **Sonic Treatment of Metallic Metals.** H. J. Seemann and H. Staats. *Acustica,* v. 6, no. 4, 1956, p. 325-334.

Electrodynamic methods are compared. An instrument suitable for investigation of sonic properties is described, and results obtained with different materials are discussed. 9 ref. (Q21f, E25q, 1-3)

351-Q. (German.) **Wave Velocity of Metals at Their Melting Point.** Werner Schaffs. *Acustica,* v. 6, no. 4, 1956, p. 387-390.

At the melting point of zinc, cadmium, tin, lead, bismuth, mercury, sodium, potassium, rubidium, cesium and gallium, the velocities quotient for longitudinal waves in solid and liquid phases is approximately 1.26. The velocities quotient for dilational waves in the solid phase and for longitudinal waves in the liquid phase is approximately 1.03, or for practical purposes 1. 7 ref. (Q21f, P12n)

352-Q. (German.) **Susceptibility to Cracking of Concrete Reinforcing Steel Bars With Cross Ribs.** Werner Lückerath. *Stahl und Eisen,* v. 77, Jan. 10, 1957, p. 11-15.

About 5000 cross-ribbed concrete reinforcing steel bars with diameters from ¼ to 1 in. were used for reverse bending tests with different angles of bending. Cracking occurred near cross ribs. (Q5, T26a; ST, 9-22)

353-Q. (German.) **Theory of Plasticity. IV.** Alfred Seeger. *Zeitschrift für Naturforschung,* v. 11a, Dec. 1956, p. 985-998.

Plastic behavior of metals with hexagonal crystal structures (i.e. zinc, cadmium and magnesium). 80 ref. (Q24, M26n; Zn, Cd, Mg)

354-Q. (Italian.) **Theoretical and Technical Study of Plastic Flexure. Part I. Qualitative Examination of the Problem of Deformation.** Riccardo Levi. *Ingegneria Meccanica,* April 1956, p. 23-27.

Deals with sheet metal in general, mild steel in particular, both under simple bending and simultaneous tensile stresses. Results of constancy of volume on deformation; mechanics of plastic flexure; practical examples. (To be continued.) (Q24, Q5; CN, 4-3)

355-Q. (Italian.) **Theoretical and Technical Study of Plastic Flexure. Part II. Quantitative Examination of the Problems of Plastic Deformation.** Riccardo Levi. *Ingegneria Meccanica,* v. 5, May 1956, p. 5-15.

Deals with sheet metal in general, mild steel in particular. Use of experimental data discussed; basic equations interpreted. (Q24; CN, 4-3)

356-Q. (Italian.) **Function of Layers of Metallic Oxides on Lubrication Surfaces.** Arnaldo Recine. *Ingegneria Meccanica,* v. 5, Aug. 1956, p. 45-48.

Protective role of metallic oxides on lubrication surfaces; prevention of direct contact of metals and therefore of binding. Study of physical and mechanical properties of layers of metallic oxides reveals why certain metals are generally excluded from use in metal construction. (Q9p)

357-Q. (Italian.) **High-Quality Light Alloys for Mechanical Construction.** Arrigo Perrone. *Ingegneria Meccanica,* v. 5, Sept. 1956, p. 9-16.

General characteristics of aluminum and its cast and wrought alloys, from point of view of composition, response to improvement and use. Applications of these alloys in mechanical construction, and reactions to tension, compression, combined compressive and bending stresses,

cutting, torsion, both "cold" and at high temperatures. General criteria for selection of aluminum alloys. (Q general, T26; Al)

358-Q. Residual Stresses in Thorium Slugs. J. W. Joseph, Jr., and J. W. Walker. E. I. duPont de Nemours and Co. *U.S. Atomic Energy Commission,* DP-169, Sept. 1956, 28 p.

Residual stresses of 2000 to 8000 psi. in compression were measured at the surface of cylindrical slugs of thorium. The stresses were measured by boring holes in the slugs and measuring the resulting surface deformation with strain gages. The tensile stresses that result from thermal gradients in the slugs during irradiation are partially counteracted by these residual stresses. (Q25h, 1-4, 2-17; Th)

359-Q. Effects of Irradiation on the Tensile Properties of Uranium. R. E. Hueschen, R. S. Kemper and W. S. Kelly. General Electric Co., *U.S. Atomic Energy Commission,* HW-41690, Feb. 9, 1955, 28 p.

Effect of neutron irradiation on the tensile properties of uranium determined at room and at elevated temperatures. Evaluation of the test results shows that damage may be a serious deterrent to competitive operation of nuclear power plants. 17 ref. (Q27a, 2-17, W11; U)

360-Q. Performance of Stainless Steel Sandwich Construction at High Temperatures. V. C. Setterholm and E. W. Kuenzi. Forest Products Laboratory (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121681, Sept. 1956, 39 p. $1.00.

New all-metal sandwich material, composed of a light-weight core of stainless steel honeycomb with stainless steel facings, has shown promise as a high-temperature material for construction of airframes for high-speed aircraft. This report contains results of tests of strength properties of various types of metal sandwich construction. (Q27a, 2-12, T24a; SS, 7-9)

361-Q. The Principles of Dispersion Hardening Which Promote High-Temperature Strength in Iron-Base Alloys. E. E. Underwood, A. R. Elsea and G. K. Manning. Battelle Memorial Institute (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121455, June 1956, 68 p. $1.75.

Goal of this investigation was to determine the underlying principles affecting the high-temperature strength of particulate iron-base alloys. Creep strengths, tensile strengths and hot hardness were measured at 80 to 1200° F. in single-phase ternary alloys with a base composition of iron with 20% chromium. Ternary additions were titanium, beryllium or boron. Hardnesses of ternary alloys were correlated by a function of lattice strain and relative valence. (Q3m, Q27a, Q29n, 2-12; SGA-h)

362-Q. Mechanical Properties of Porosity-Graded 195 Alloy: Part I—Tensile Properties. I. J. Feinberg (U.S. Naval Ordnance Laboratory) *U.S. Office of Technical Services,* PB 121456, June 1956, 44 p. $1.25.

The correlation of the radiographic appearance of discontinuities with mechanical properties in light alloy castings. A study was made on the effects of hydrogen gas porosity on the tensile properties of 195 alloy casting material. Metallographic illustrations of elongated hydrogen gas porosity in the test material are presented, providing base required for association with derived tensile properties. (Q27a, P10m, S13e; Al, 5)

363-Q. Mechanical Property, Corrosion and Welding Studies on 6066 Aluminum Alloy. J. D. Wood. (Wright Air Development Center) *U.S. Office of Technical Services,* PB 121497, June 1956, 36 p. $1.00.

Aluminum alloy 6066, an aluminum-magnesium-silicon-copper-manganese-chromium alloy was evaluated as a material for use in Air Force weapons systems. (Q general, R general, K9s; Al)

364-Q. Survey of Low-Alloy Aircraft Steels Heat Treated to High-Strength—Part 4. High Strength Steel Levels and Their General Static Properties. G. Sachs and E. P. Klier. Syracuse University (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121504, Aug. 1954, 145 p. $3.75.

Factors considered in selecting high-strength steels and assemblies, the available information on the effects of the numerous variables encountered in making, shaping and heat treating low-alloy steels, and their significance for the strength properties of aircraft parts. (Q23b, T24; AY-n)

365-Q. Survey of Low-Alloy Aircraft Steels Heat Treated to High-Strength Levels. Part 5. E. P. Klier. Syracuse University (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121505, Sept. 1954, 150 p. $3.75.

Results of impact tests and notch-tension tests on high-strength steels. The impact strength of constructional low-alloy steels generally exhibits a minimum at tempering temperatures between 500 and 700° F. for short tempering times, making preferable steels tempered either at 400 or over 800° F. High-strength steels with optimum impact strength at a given strength level are obtained by holding the carbon content as low as possible. (Q6n, Q27d, 2-14; AY)

366-Q. Survey of Low-Alloy Aircraft Steels Heat Treated to High-Strength Levels—Part 6. Recommendations for Future Research Work on High-Strength Steels. G. Sachs and E. P. Klier. Syracuse University (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121506, Sept. 1954, 9 p. $.50.

An integrated over-all program is proposed for the study of a considerable number of pertinent properties of 4340 steel and a few competitive steels and the development of design data for these is recommended for future work. Consideration of the effects of commercial variations and limitations in carbon and alloy constituents, ingot size, steelmaking and breaking-down practices is particularly desired. (Q23b, T24; AY-n)

367-Q. Investigation of Stress-Relief Procedures for Titanium and Titanium Alloys. F. J. Gillig. Cornell Aeronautical Laboratory (U.S. Wright Air Development Center). *U.S. Office of Tecnical Services,* PB 121570, Aug. 1956, 82 p. $2.25.

Causes and effects of residual stresses in titanium aircraft parts, and development of thermal treatments to relieve the stresses. Fundamental principles for the build-up of residual stresses are reviewed. The difference between micro and macrostresses and the relationship between these stresses and the properties of the material are discussed. (Q25h, J1a; Ti)

368-Q. Mechanical Properties and Corrosion Behavior of Zircaloy-3. F. Forscher, S. Kass and K. Goldman. *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 69-88. (CMA)

A comparison of the mechanical and corrosion properties of Zircaloy-2, 3a, 3b and 3c shows that Zircaloy-2 is the strongest and Zircaloy-3a is the weakest, that ductility is much the same, and that the post-transition corrosion rate of Zircaloy-3a in 750° F. steam and 600° F. water is the lowest. In the pretransition state the corrosion rates are all similar. (Q general, R4; Zr)

369-Q. On the Mechanical Metallurgy of Zircaloy-3b. D. E. Johnson. *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 65-68. (CMA)

Tensile properties in Zircaloy-3b were tested using annealed and cold worked specimens; tests were conducted at −50, 22, 100, 200 and 300° C. Strength is good although less than in Zircaloy-2. Evidence of low-temperature aging appeared in water-quenched specimens. The ductility of cold-worked specimens may be restored by short-time annealing. (Q27a, 2-15; Zr)

370-Q. (Book.) **Report on Elevated-Temperature Properties of Wrought Medium-Carbon Alloy Steels.** American Society for Testing Materials. Special Technical Publication, SPT 199, 1957, 127 p. $4.25.

Graphical summary of the elevated-temperature strength data for medium-carbon alloy steels. Includes summary curves for tensile strength; 0.2% offset yield strength; per cent elongation and reduction in area; stresses for rupture in 100, 1000, 10,000 and 100,000 hr.; and stresses for creep rates of 0.0001 and 0.00001% per hr. (1% in 10,000 and 100,000 hr.). Data for 27 steels representing approximately a dozen alloy types are given. (Q27a, Q23b, Q3m, 2-12; AY)

Corrosion

101-R. Study of a Size Effect in Galvanic Corrosion. James T. Waber. *Corrosion,* v. 13, Feb. 1957, p. 25-32.

Distribution of potential within a corrodent was analyzed using several geometric arrangements of electrodes which lay in a common surface. Distribution of corrosion attack over anode studied. It was found that potential of a galvanic couple depended on relative areas of electrodes, as well as on their open cell potentials. 23 ref. (R1a)

102-R. Use of High Silicon Cast Iron for Anodes. NACE Technical Unit Committee T-2B on Anodes for Impressed Currents. *Corrosion,* v. 13, Feb. 1957, p. 33-37.

Reports of data received in reply to questionnaires, which indicate high-silicon cast iron anodes can be expected to perform satisfactorily both with and without coke breeze ground beds. (R10d, 17-7; CI, Si)

103-R. An Impressed Current Cathodic Protection System Applied to a

Submarine. E. E. Nelson. *Corrosion,* v. 13, Feb. 1957, p. 52-54.

Platinum-clad copper anodes were employed. Inspection after a ten-month period showed the hull to be in excellent condition. Laboratory tests indicate desirability of replacing copper anode core by a silver core. (R10d, 17-7; Cu, Ag)

104-R. Cathodic Protection of an Active Ship Using a Trailing Platinum-Clad Anode. H. S. Preiser and F. E. Cook. *Corrosion,* v. 13, Feb. 1957, p. 55-61.

Advantages of trailing anode over existing hull-mounted anode systems, and speculation as to future possibilities in the marine field. 11 ref. (R10d, 17-7; Pt)

105-R. Casing Corrosion in the Petroleum Industry. Jack L. Battle. *Corrosion,* v. 13, Feb. 1957, p. 62-68.

Areas in which casing corrosion is most troublesome. Investigation, repairing and prevention discussed. 11 ref. (R7a)

106-R. Lead Cable Sheath Corrosion Under Cathodic Protection Conditions. Walter H. Bruckner and Ray M. Wainwright. *Corrosion,* v. 13, Feb. 1957, p. 73-78.

Laboratory tests were conducted in cells containing aqueous solutions of chlorides and alkali and with soil saturated with the various solutions. Results indicated that no corrosion of cable sheath occurred so long as the cathode was receiving protective current. Suggested factors for service-type failures. 11 ref. (R10d; Pb)

107-R. The Standard Salt-Spray Test—Is It a Valid Acceptance Test? A. Mendizza. *Plating,* v. 44, Feb. 1957, p. 166-171.

Test results from four different testing boxes of chromium plated on nickel or copper coated steel were not consistent. Similar platings from six sources gave inconsistent results; apparently salt spray procedure as currently practiced fails to perform as a standard test. (R11j)

108-R. (French.) **Findings on the Chemical Activity of Water and the Composition of the Products of Incrustation and Corrosion.** T. Samuel. *Révue Technique Luxembourgeoise,* no. 4, Oct.-Dec. 1956, p. 205-207.

Chemical nature of the several types of corrosion in water mains; inhibiting factors and methods of prevention. (R4a, R10b)

109-R. Solving Unexpected Corrosion Problems. G. D. Gardner. *Chemical Engineering,* v. 64, Feb. 1957, p. 292-300.

Correction of corrosion problems of sulphuric acid: high-velocity steam corroded steel pipe elbows; sulphuric acid containing carbon caused galvanic corrosion of alloys; corrosion of copper by sulphur dioxide. (R6g, R6p, R4d; ST, Cu)

110-R. Electrochemical Corrosion in Relation to Engineering Design. S. L. Chawla. *India Section, Electrochemical Society, Bulletin,* v. 5, Oct. 1956, p. 78-82.

Factors leading to galvanic corrosion and their practical implication. Corrosion of a single structure or a metal piece may be due to one or more causes. Protective measures discussed. 10 ref. (R1a, 17-1)

111-R. Corrosion Resistance of Copper and Copper-Base Alloys. A. I. Heim. *Industrial and Engineering Chemistry,* v. 49, Feb. 1957, p. 79A-80A.

Brief description of pitting, dezincification, corrosion-fatigue, stress-corrosion cracking and galvanic corrosion in copper and copper alloys. (R1, R2; Cu)

112-R. Short Period Testing With a New Corrosion Test Chamber. W. Hess. *Industrial Finishing,* v. 9, Jan. 1957, p. 342-345.

Experimental results for salt spray corrosion tests obtained with aerosols centrifugally produced indicated a versatility in producing corrosion conditions. Test results were reproducible. (R11j)

113-R. Corrosion in Scotch Marine Boilers I. Model Boiler Tests on the Corrosion of Mild Steel Tubes in Highly Saline Waters. F. Wormwell, G. Butler and J. G. Beynon. *Institute of Marine Engineers,* Preprint, Feb. 1957, 12 p.

Model boilers have been used to carry out qualitative and semiqualitative experiments on the corrosion of internally heated boiler tubes in conditions simulating those in Scotch boilers. The depth of pitting on mild steel boiler tubes in distilled water with additions of sea water increases with the density of the solution. 11 ref. (R4b, W11, 17-7; CN)

114-R. The Protection of Structural Steelwork Against Atmospheric Corrosion. F. Fancutt. *International Association for Bridge and Structural Engineers, Publications,* v. 16, 1956, p. 185-230.

Influence of climate on the severity of atmospheric rusting, effect of steel composition on rusting, general survey of protective measures and design, general principles governing the use of protective coatings, protection by painting and metallic coatings.
(R3, L general; ST, SGB-s)

115-R. Effect of Alternate Corrosion and Abrasion on Some Ferrous Metals. J. Dearden and J. D. Swindale. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 227-234.

The resistance of 11 ferrous metals to atmospheric corrosion, to abrasion, and to certain combinations of both, have been compared. Resistance to abrasion alone was found to be related to a defined equivalent carbon content of the steels tested rather than to their hardness. 12 ref. (R3, Q9n; CI, ST)

116-R. Corrosion of Titanium. D. W. Stough, F. W. Fink and R. S. Peoples. *Light Metal Age,* v. 15, Feb. 1957, p. 20-22. (CMA)

Titanium corrosion resistance is good in general and is especially valuable in environments of sea water, HNO_3, chromic and acetic acid, ferric and cupric chlorides. It is possible to inhibit the attack of HCl, H_2SO_4, $(COOH)_2$ and HCOOH, but the attack of HF cannot be inhibited. Galvanic attack of the other metal in a galvanic couple is a problem. Titanium is subject to crevice corrosion in some acid environments; reactions with corrosive environments are often complex. There is a tendency to polarize the galvanic current between titanium and other metals. (R general; Ti)

117-R. Close Tolerance Wrought Iron Tubing. H. K. Siefers, Jr. *Materials and Methods,* v. 45, Feb. 1957, p. 116-117.

Availability of cold drawn tubing with close tolerances allows use in corrosive environments where wrought iron performs well.
(R general; Fe-m, 4-10)

118-R. Heat Exchanger Corrosion. *Metal Industry,* v. 90, Feb. 1, 1957, p. 89-90.

Use of dissimilar metals of widely varying electrode potential caused the corrosion. (R1a, W13, 17-7)

119-R. Acid Resisting Property of High Chromium Stainless Steels. Masayoshi Tagaya and Shigeteru Isa. *Osaka University, Technology Reports,* v. 5, Oct. 1955, p. 433-440.

Several 20-27% chromium stainless steels containing 5 or 10% nickel, 1% molybdenum and 1% copper were examined. The effect of heat treatment from 700 to 1100° C. and the effect of additions of inhibitors to the boiling acid solution on the stabilization of the acid resistance. (R6g, R10b, 2-14; SS)

120-R. (English.) **Corrosion Testing Stations of the French Iron and Steel Industry.** *Aciers Fins et Spéciaux Francais,* no. 24, Dec. 1956, p. 10-14.

Material damage due to corrosion; methods of studying corrosion; survey of the equipment and operating possibilities of the French corrosion testing stations located at St. Germain-en-Laye, Saint Denis and Biarritz. 13 ref. (R11, A9h)

121-R. (French.) **Oxidation at High Temperatures of Nickel-Chromium Alloys.** J. Moreau. *Corrosion et Anticorrosion,* v. 4, June 1956, p. 211-216.

Formation of oxides; photomicrographic studies of oxidation; resistance to corrosion. 7 ref.
(R1h, 2-12; Ni, Cr)

122-R. (French.) **Protection Against Humidity in the Storage and Shipment of Material, With Special Reference to Motors, by Means of Dehydrating Agents.** R. Baudoin. *Corrosion et Anticorrosion,* v. 4, June 1956, p. 222-224.

Principal dehydrating agents and their mode of action; protection problems concerning humidity in the aeronautical industry and progress currently realized. (R3, R10a)

123-R. (French.) **Corrosion by Steam and Distilled Water Circuits—Causes and Prevention.** J. Pierrey. *Corrosion et Anticorrosion,* v. 4, June 1956, p. 225-230.

Corrosive character of steam and its causes; chemical nature of such corrosion; methods of prevention including caustic soda and film-forming amines resulting in effective corrosion inhibiting factors and reduction in industrial costs. 6 ref. (R4d, R10b)

124-R. (French.) **On the Morphology of Superficial Oxide Films.** R. Collongues and R. Sifferlen. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 53, Oct. 1956, p. 803-809.

Mechanism of oxidation; formation and structure of oxide films on metal surfaces; crystal growth; diffusion processes. 12 ref. (R1h, N1)

125-R. (French.) **Reactions of the Iron-Nickel Alloys With Oxygen.** M. J. Brabers, W. J. Heidiger and C. E. Birchenall. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 53, Oct. 1956, p. 810-816.

Study of the oxidation of iron-nickel alloys of various compositions at 1050 to 1095° C.; rate of oxidation; microscopic, X-ray and chemical analysis to determine structure and composition of oxide films. 10 ref. (R1h; 1-4; Fe, Ni)

126-R. (French.) **Note on the Growth of Films on Metals.** T. P. Hoar. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 53, Oct, 1956, p. 826-831.

Theoretical study of the speed of oxidation and the variables influencing this process; elaboration of

equations of growth and structural formulae; rate-determining factors. 19 ref. (R1h, 3-17)

127-R. (French.) **On the Mechanism of Oxidation of Metals by Nonparabolic Law.** Karl Hauffe. *Journal de Chimie Physique et de Physico-Chimie Biologique*, v. 53, Oct. 1956, p. 855-870.

Migration processes and phase boundary reactions during oxidation; parabolic law of growth; logarithmic rate law; oxide = metal interfaces; interaction between diffusion processes and phase-boundary reactions. 39 ref. (R1h, 3-17, Ni)

128-R. (French.) **Results of Research Into the Kinetics of the Oxidation of Molybdenum and Tungsten and Into the Nature of the Resultant Oxides.** K. M. Gorbounova and V. A. Arslambékov. *Journal de Chimie Physique et de Physico-Chimie Biologique*, v. 53, Oct. 1956, p. 871-883.

Oxidation of molybdenum and tungsten in various conditions of temperature and pressure; structure of oxide film; kinetic curves relating to the interaction of oxygen with the metal surfaces; equations based on experimental data. 9 ref. (R1h, M26r; Mo, W)

129-R. New Data on Stress-Corrosion Cracking of Brass. *ASTM Bulletin*, no. 220, Feb. 1957, p. 37.

National Bureau of Standards investigation of the relationship between crystal orientation and stress-corrosion cracking in alpha and beta brasses. (R1d, 3-22; Cu-n)

130-R. Thermogalvanic Potentials and Currents at Aluminum Surfaces in Industrial Water. E. C. Pitzer. *Electrochemical Society, Journal*, v. 104, Feb. 1957, p. 70-74.

Potentials and galvanic currents at 2S aluminum surfaces in Columbia River water were studied between room temperature and 100° C. The Al potential changed by approximately 0.6v over this interval, becoming more anodic with increase in temperature. Similar but somewhat smaller changes in potential were noted in buffer solutions. 20 ref. (R4a; Al)

131-R. Corrosion Problems in Aircraft. Part I and II. A. T. Pal. *Institution of Engineers, Journal* (India), v. 37, no. 4, Part 2, Dec. 1956, p. 353-357.

Corrosion problems in aircraft are associated with a wide range of metals and their alloys, such as aluminum, magnesium, copper, nickel, stainless steel, low-carbon steel, as well as with zinc, chromium and cadmium-plated parts. Problems which still need further investigation. 12 ref. (R general, T24)

132-R. Corrosion in Scotch Marine Boilers II. Model Boiler Tests on the Influence of the Copper Content of the Steel on the Corrosion of Tube in Artificial Sea Water. G. Butler and H. C. K. Ison. *Institute of Marine Engineers*, Preprint, Feb. 1957, p. 13-20.

Model boiler tests have been carried out to determine the influence of the copper content of steel on the corrosion resistance of mild steel boiler tubes in artificial sea water. Experiments with steels containing from less than 0.01% copper to 0.20% show that copper has some value in reducing the severity of pitting of tubes. 18 ref. (R4b, 2-10; ST, *Cu*, 4-10)

133-R. (French.) **Selective Oxidation of Iron-Chromium Alloys in the Neighborhood of the Equilibrium of Dissociation of Cr_2O_3.** J. Moreau and J. Benard. *Journal de Chimie Physique et de Physico-Chimie Biologique*, v. 53, Oct. 1956, p. 787-797.

Nature of the oxidation and effect on the surface of the metal. 8 ref. (R1h; Fe, Cr)

134-R. (French.) **Study of Dry Rust in Copper-Manganese Alloys.** F. Bouillon and M. Jardinier. *Journal de Chimie Physique et de Physico-Chimie Biologique*, v. 53, Oct. 1956, p. 817-822.

Dry rust in copper-manganese alloys of 1.5%, 4.31% and 7.36% manganese composition; microscopic examination of samples. Presence of manganese serves to retard the rate of oxidation. 11 ref. (R1h; Cu, *Mn*)

135-R. (German.) **Corrosive Properties and Passivation of Titanium and Its Alloys.** Ulrich Zwicker. *Chemie-Ingenieur-Technik*, v. 29, Feb. 1957, p. 107-109. (CMA)

It is known that mixtures of hydrochloric and nitric acid generate corrosion resistant films on the surface of titanium and its alloys. A closer study of this phenomenon was made by observing the corrosive behavior of pure titanium, of commercial titanium containing considerable iron, and of the ternary alloys titanium-chromium-aluminum and titanium-aluminum-vanadium in the presence of 20% hydrochloric acid alone or in mixtures with various amounts of nitric acid. In view of the differences in the composition of the materials examined, the differences observed are rather complicated, some alloys being less resistant than pure titanium while others are more resistant. In most cases the addition of 1.3% nitric acid to hydrochloric acid produced the strongest passivation effects. (R10c, R6g; Ti)

136-R. Corrosion and Other Aspects Relative to the Use of Diphenyl as a Coolant-Moderator. Gustave C. Milak. Argonne National Laboratory. *U.S. Atomic Energy Commission*, ANL-5587, Nov. 1956, 43 p.

In over 4500 hr. of testing in static diphenyl at 500, 680 and 750° F., uranium and high-uranium alloys showed considerably lower corrosion rates and no tendency toward catastrophic failure by comparison with their counterparts in high-temperature water. Corrosion of structural and cladding materials was, in general, equivalent to that of stainless steel in water. Diphenyl showed much better lubricating qualities than water. (R4a, 2-12, T11; U)

137-R. Statistical Analysis of the Corrosion of Uranium—Part I. Tests in Moist Helium and the Effects of Impurities. James T. Waber. Los Alamos Scientific Laboratory. *U.S. Atomic Energy Commission*, LA-1355, Jan. 31, 1952, 23 p.

Corrosion data from seven duplicate runs analyzed statistically and the slope and rate constant calculated for each run. Carbon appears to have the greatest effect on the slope. (R11a; S12, 3-19; U)

138-R. Stress Corrosion Cracking in Type 403 Stainless Steel. M. G. Fontana. Ohio State University Research Foundation (Wright Air Development Center). *U.S. Office of Technical Services*, PB 121414, Aug. 1956, 59 p. $1.50.

Mechanism of cracking due to stress-corrosion, which reportedly has caused fatigue failures in compressor blades of jet engines, is studied in tests of stainless steel alloys type 403, 420 and 431. The effects of austenitizing temperatures on hardness, impact strength, and microstructure were determined. Except for variations noted in the tempering temperature above which stress-corrosion cracking susceptibility was lost, all data indicated that the mechanism of stress-corrosion is the same for the three steels. (R1d; SS)

139-R. (Book.) **Stress Corrosion Cracking and Embrittlement.** William D. Robertson. 202 p. 1956. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $7.50.

Eighteen authorities give extensive experimental and theoretical consideration to the significance of stress-corrosion cracking phenomena, with respect to stability and safety of structures. (R1d)

Inspection and Control

113-S. Spectrographic Technique for the Determination of Gallium in Micro Samples. E. M. Murt. *Applied Spectroscopy*, v. 10, no. 4, 1956, p. 210-212.

Spectrographic technique to enhance the sensitivity of gallium determination in microsamples of indium-gallium alloys. Helium atmosphere used. (S11k; Ga)

114-S. Freezing Points of High Purity Metals as Precision Temperature Standard. Part 1. Precision Measurements With Standard Resistance Thermometers. E. H. McLaren. *Canadian Journal of Physics*, v. 35, Jan. 1957, p. 78-90.

Techniques and difficulties in measuring temperature to the highest precision with platinum resistance thermometers. (S16k)

115-S. Contributions to a Solution of the Problem of Short Duration Tests for Determining the Life of Turning Tools. E. Bickel. *Microtecnic*, v. 10, no. 5, p. 209-214.

Objectives and difficulties of short tests, proposals for valid tests. (S21, T6)

116-S. Search for Uranium. (Second Edition.) W. S. Savage. *Ontario Department of Mines, Bulletin* 148, 1954, 15 p.

Uranium and thorium minerals; visual identification, determination by radioactivity, Geiger counter in prospecting for minerals. Methods of analysis and interpretation of assays. (S10, S11s, S19f; U, Th, 14-9)

117-S. Quality Control for Automatics. Harmon S. Bayer and Ray F. Engelgau. *Steel*, v. 140, Feb. 18, 1957, p. 178-180, 183, 186, 189.

Use of statistical quality control has reduced inspection labor, cut scrap, decreased repairs and minimized customer complaints for producer of automatic screw machine products. (S12, G17g)

118-S. (French.) **Practical Radiographic and Ultrasonic Control of Metallic Parts.** Wiltz and Ruch. *La Normandie Industrielle*, no. 29, Sept. 1956, p. 13-24.

The application of X-rays, gamma rays, isotopes (iridium-192 and cobalt-60) in metallurgical processes such as welding. Notes the measures of protection to be taken to safeguard personnel and furnishes

details of the construction of equipment currently employed for radiological and ultrasonic detection.
(S13e, S13g, K general, 1-24)

119-S. (French.) New Method for the Determination of Uranium, Radium, Thorium and Actinium in Fine Particles of Radioactive Ore. G. Becquerel. *Journal de Physique et le Radium Physique Appliquée*, v. 17, Nov. 1956, p. 137A-142A.

Technique permitting the simultaneous determination of the presence of uranium, radium, thorium, actinium in very fine particles of radioactive ore by study of the alpha radiation emitted.
(S19; U, Ra, Th, Ac, RM-n)

120-S. (French.) Applications of Ultrasonics in Metallurgy and Mechanics. P. Hemardinquer. *Revue Centrale de Mécanique*, no. 95, Dec. 1956, p. 429-433.

Use of ultrasonic processes in testing materials and flaw detection and the correction of defects in castings.
(S13g)

121-S. Determination of Traces of Boron in Nickel. R. C. Chirnside, H. J. Cluley and P. M. C. Proffitt. *Analyst*, v. 82, Jan. 1957, p. 18-24.

Determination of boron at the level of a few parts per million in nickel sheet used for the anodes of thermionic valves. The sample is made the anode of a mercury cathode electrolysis apparatus and dissolution of the sample and deposition of dissolved nickel into the mercury proceed simultaneously; the boron in the electrolyte is determined spectrophotometrically by the curcumin method. 6 ref.
(S11f, S11k; Ni, *B*)

122-S. Developments in the Micro Vacuum Fusion Method With Particular Reference to the Determination of Oxygen, Nitrogen and Hydrogen in Beryllium, Titanium, Zirconium, Thorium and Uranium. E. Booth, F. J. Bryant and A. Parker. *Analyst*, v. 82, Jan. 1957, p. 50-61.

Applications of the micro vacuum fusion technique. 14 ref.
(S11r; Be, Ti, Zr, Th, U, *O*, *N*, *H*)

123-S. Determination and Separation of Copper in Metallurgical Products. B. C. Stathis. *Analytica Chimica Acta*, v. 16, Jan. 1957, p. 21-24.

Rivot's process for the separation and the determination of copper as cuprous thiocyanate has been modified. The modified method involves the reduction of cupric ion in nitric acid solution by ascorbic acid and makes the procedure practicable. The method is applied to a wide variety of metallurgical products.
(S11f; Cu)

124-S. Direct Spectrophotometric Determination of Thorium With SPADNS. Gurapada Banerjee. *Analytica Chimica Acta*, v. 16, Jan. 1957, p. 56-61.

A direct spectrographic method for the determination of thorium using SPADNS (sodium salt of 2-p-sulphophenylazo—1.8 dimydroxynaphthalene-3, 6 disulphuric acid) as a reagent. Moderate amounts of uranium and rare earths do not interfere. The stoichiometric composition of the colored complex has been determined spectrophotometrically by the "slope ratio method". 11 ref.
(S11k; Th)

125-S. Determination of Uranium in Alloy Systems. G. W. C. Milner and J. W. Edwards. *Analytica Chimica Acta*, v. 16, Feb. 1957, p. 109-114.

A procedure for the determination of the uranium content of metallurgical alloys containing this element as a minor constituent, by quantitative chemical analysis.
(S11; U)

126-S. Determination of Sodium in Aluminum-Copper Alloys Using the Flame Photometer. H. F. Hourigan and J. W. Robinson. *Analytica Chimica Acta*, v. 16, Feb. 1957, p. 161-164.

A flame photometric method of determining sodium in plain aluminum. Method has now been extended to the analysis of aluminum-copper alloys. Silicon does not interfere with the method which is rapid and reasonably accurate.
(S11a; Al, Cu, *Na*)

127-S. The Polarographic Determination of Aluminum in Zinc-Base Die-Casting Alloys. J. A. Page, D. H. Simpson and R. P. Graham. *Analytica Chimica Acta*, v. 16, Feb. 1957, p. 194–200.

A procedure for the direct polarographic determination of aluminum, with particular reference to zinc-base die-casting alloys. Interfering elements are removed by electrolysis of a solution of the alloy in a mercury-cathode cell. 14 ref.
(S11m; Zn, *Al*, 5-11)

128-S. Quantitative X-Ray Spectrograph Analysis for Uranium With the Use of an Internal Standard. Joseph H. Cope. *Norelco Reporter*, v. 3, Mar.-Sept. 1956 p. 41-43.

For precise quantitative X-ray analysis, the comparison of the unknown sample with standards of almost like composition can correct for disturbing effect quite well. 12 ref. (S11k; U)

129-S. Quantitative Determination of Thorium and Uranium in Solutions by Fluorescent X-Ray Spectrometry. George Pish and Audrey A. Huffman. *Norelco Reporter*, v. 3, Mar.-Sept. 1956, p. 50-53.

A rapid and accurate X-ray fluorescent spectrometric method has been developed in which aqueous and organic solutions can be analyzed directly. 7 ref. (S11c; Th, U)

130-S. Fluorescent X-Ray Spectrographic Determination of Tantalum in Commercial Niobium Oxides. William J. Campbell and Howard F. Carl. *Norelco Reporter*, v. 3, Mar.-Sept. 1956, p. 74-76.

Recent modification in fluorescent X-ray spectrographic instrumentation permits spectra resolution of columbium and tantalum; general analytical theory and procedure, preparation of standards. 8 ref.
(S11c; Ta, Cb)

131-S. (Czech.) Separation and Detection of Vanadium, Molybdenum and Titanium by Capillary Chromatography. P. Cerny. *Chemicke Listy*, v. 50, Dec. 1956, p. 2026-2028. (CMA)

A capillary of 0.01 ml. capacity is filled with solution of the tested material, and emptied upon filter paper which has been moistened with ammonia. Developed with pyrocatechin, the chromatogram consists of separated concentric rings: the outer (yellow) indicates titanium; the middle (orange), molybdenum; and the inner (blue), vanadium. Iron, if present in considerable proportion as in steels, should be eliminated with rhodanide. The test lasts 3-10 min., is performed with drops, requires minute amounts of material (steel, alloys, ores) and is very sensitive. 3 ref.
(S11f; V, Mo, Ti)

132-S. (German.) Radio-Isotopes in Metallurgy and Metallography. Traude Bernert. *Berg und Hüttenmännische Monatshefte*, v. 101, Nov. 1956, p. 213-219.

Isotopes as indicators, in diffusion, microstructural research, abrasions, aluminum casting and refining, continuous process control, thickness control and radiography. 11 ref.
(S18, S13e, S14e, N1a, M23q; 14-13)

133-S. (German.) Applications of Radiography in Metallurgy. E. Broda. *Berg und Hüttenmännische Monatshefte*, v. 101, Nov. 1956, p. 228-232.

Tabulation and discussion of metal isotopes showing half life of elements and analytical application of isotopes. (S11q; 14-13)

134-S. (German.) Examples of Isotope Research in the Iron and Steel Industry. Helmut Krainer. *Berg und Hüttenmännische Monatshefte*, v. 101, Nov. 1956, p. 246-255.

Isotopes in nondestructive materials testing, phosphorus segregation, nickel-molybdenum steel testing and abrasion measuring. 11 ref.
(S general, Q9n, 1-4; ST, *P*, 9-19)

135-S. (Italian.) Industrial Inspection of Welds by X-Ray and Quantitative Evaluation of Defects Revealed. Porosity Due to Use of Damp Electrodes in Welding of Steel. Part I. Marco Robba. *Ingegneria Meccanica*, v. 5, Aug. 1956, p. 33-39.

Analysis of current standards for X-ray inspection of welds and for interpretation of radiographs; examination of possibility of a quantitative evaluation of defects. (Continued.)
(S13e, 9-18; 7-1)

136-S. (Italian.) Industrial Inspection of Welds by X-Ray and Quantitative Evaluation of Defects Revealed. Porosity Due to Use of Damp Electrodes in Welding of Steel. Part II. Marco Robba. *Ingegneria Meccanica*, v. 5, Oct. 1956, p. 43-48.

Details of series of tests on steel welds determined porous by radiography, microphotometry and mechanical means.
(S13e, S13d, S13b, 9-18; 7-1)

137-S. (Japanese.) Studies on the Elements in Small Quantities in Iron and Steel. III. On The Titanium and Zirconium Nitrides in Iron and Steel. Kiichi Narita. *Chemical Society of Japan, Journal, Pure Chemistry Section*, v. 77, Oct. 1956, p. 1536-1539. (CMA)

When iron or steel samples containing nitrogen and titanium or zirconium are treated with dilute hydrochloric acid, the titanium nitride and zirconium nitride will remain quantitatively in the residue without dissolving. These nitrides are Berthollide-type compounds with basic compositions TiN and ZrN. The nitrides undergo quantitative changes during heat treatment, with outward appearance of reversibility, as $TiN \rightleftharpoons [Ti] + [N]$ and $ZrN \rightleftharpoons [Zr] + [N]$. Equilibrium concentration products of titanium and zirconium nitrides were sought for γ-Fe. 8 ref.
(S11; ST, *Ti*, *Zr*)

138-S. (Japanese.) Rapid Method of Determining Iron in Aluminum. Simultaneous Determination of Copper and Iron in Aluminum. Part 4. Jisuke Seki. *Japanese Scientific Research Institute, Reports*, v. 32, Nov. 1956, p. 212-217.

Method and results of the chemical analysis; disposal of silicic acid

and cupric oxide in precipitate, effect of fluoric oxide titration. (S11j; Al, *Cu, Fe*)

139-S. (Russian.) **Spectral Analysis of the Gd, Eu, and Sm Content of Metals.** A. N. Zaydel, N. I. Kaliteyevskiy, A. A. Lipovskiy, A. N. Razomovskiy and P. P. Yakimova. *Vestnik Leningradskogo Universiteta,* v. 11, Oct.-Dec. 1956, p. 18-40.

Determination of traces of rare earths in uranium, beryllium, bismuth and other metals; separation of rare earths from beryllium and zirconium. (S11k; EG-g, Be, Zr)

140-S. (Russian.) **Determination of Small Quantities of Beryllium by Means of Hydroxyquinones.** Ye. S. Przheval'skiy, T. A. Belyavakaya and A. P. Golevina. *Vestnik Moskovskoge Universiteta,* v. 11, Jan.-Feb. 1957, p. 191-196.

Colorimetric methods for the determination of beryllium with the aid of quinizarin, naphthazarin, 5, 8-dichloroquinizarin, 1-amino-4-hydroxyanthraquinone, and 1, 4, 5, 8-tetrahydroxyanthaquinone have been developed. Fluorescence methods for the determination of beryllium are proposed by the authors. (S11a; Be)

141-S. (Russian.) **Amperometric Titration of Cadmium With Potassium Iodide in the Presence of an Excess of Pyramidon.** A. K. Zhdanov, V. A. Khadeyev and Ye. K. Makritekaya. *Zavodskaya Laboratoriya,* v. 22, Nov. 1956, p. 1286-1291.

Feasibility of the amperometric titration of cadmium with potassium iodide in the presence of an excess of pyramidon has been demonstrated and the optimum set of conditions for this procedure found. (S11j; Cd)

142-S. (Russian.) **Application of Phytic Acid in the Analytical Chemistry of Thorium.** D. I. Ryabchikov, V. K. Belyayeva and A. N. Yermakov. *Zhurnal Analiticheskoy Khimii,* v. 11, Nov.-Dec. 1956, p. 658-667.

The conditions under which thorium can be precipitated quantitatively with phytic acid were investigated. It was established that upon decomposition of thorium phytinate at 1100°, thorium metaphosphate is obtained. It furthermore has been shown that quantitative separation of thorium with phytic acid can be accomplished in the presence of oxalic acid, which forms complex compounds with titanium, zirconium, uranium and iron. (S11j; Th)

143-S. A Rapid Colorimetric Method for the Determination of Aluminum in Cu-Al Alloys. M. C. Steele and L. J. England. *Analytica Chimica Acta,* v. 16, Feb. 1957, p. 148-149.

Aluminum is determined colorimetrically using Eriochrome cyanine. (S11a; Cu, *Al*)

144-S. Developments in the Micro Vacuum Fusion Method With Particular Reference to the Determination of Oxygen, Nitrogen and Hydrogen in Beryllium, Titanium, Zirconium, Thorium and Uranium. E. Booth, F. J. Bryant and A. Parker. *Analyst,* v. 82, Jan. 1957, p. 50-61. (CMA)

The vacuum fusion method may be used to determine oxygen in 10 to 20-mg. samples with good precision. Speed and ease of operation are advantages. Procedures are given for analysis of the metals named. Similar analyses of vanadium and molybdenum would probably be successful. The technique does not offer reliable results for nitrogen determinations. (S11r, 1-23; Be, Ti, Zr, Th, U)

145-S. Rapid Routine Method of Determination of Uranium in Ores. H. J. Seim, R. J. Morris and D. W. Frew. *Analytical Chemistry,* v. 29, March 1957, p. 443-446.

A rapid method for the determination of uranium in ores permits detection of as little as 0.01% uranium oxide with a precision of ±0.005%. The uranium is separated from all commonly occurring interfering ions by adsorption on an anion exchange resin. 7 ref. (SSf; U, RM-n)

146-S. Magnetic Testing as an Assist to Production Quality Control. Gerald T. Barta. *Metal Products Manufacturing,* v. 14, Mar. 1957, p. 25-27, 78, 84, 85.

Includes basic information on magnetics, reason for quality control testing, and describes the tests applicable to a wide variety of manufactured products. (S13h)

147-S. An Improved Succinate Method for the Determination of Aluminum in Ferrous Materials. R. I. Parker. *Metallurgia,* v. 55, Feb. 1957, p. 103-106.

Method described which includes substitution of potassium metabisulphite and hydroquinone in place of ammonium metabisulphite and phenylhydrazine for iron reduction. The method is not suitable for aluminum-killed mild steel, nor for samples containing fluorine. 12 ref. (S11; Fe, *Al*)

148-S. (French.) **The Applications of Ultrasonics in Metallurgy and Mechanics.** P. Hemardinquer. *Revue Generale de Mecanique,* no. 95 (New Series), Dec. 1956, p. 429-433.

Ultrasonic processes in the welding of light alloys and various types of welds; notes value of ultrasonics in determination and location of flaws, cracks and cavities; quality control; ultrasonics as applied in the foundry and in metallurgical processes in general. (S13g, K general, 1-24)

149-S. (German.) **Radioactive Isotopes in the Steel Industry.** H. Krainer and E. Krainer. *Schweizer Archiv,* v. 22, Dec. 1956, p. 402-413.

Use of isotopes as tracers and as source of gamma rays for nondestructive testing. (S13e; ST, 14-13)

150-S. (Italian.) **Use of Radioactive Isotopes in Gamma Inspection of Welds Made in Assembling Pressure Piping.** Ugo Bellometti. *Ingegneria Meccanica,* v. 5, Sept. 1956, p. 53-56.

General discussion of gamma radiography with special reference to oleoducts and methanoducts; review of current standards; technical and economic factors to be borne in mind. (S13e; 7-1, 14-13)

151-S. (Swedish.) **Methods of Carbon Determination in Cast and Pig Iron.** Rita Siethniecks. *Gjuteriet,* v. 12, Dec. 1956, p. 164-168.

Value of routine carbon determination for pig iron, gray cast iron and spheroidal graphite cast iron. (S11; CI-a, CI-n, CI-r)

152-S. Chemical Analysis of Binary Alloys of Platinum and Uranium. Martha S. Richmond, John R. Baldwin and E. June Maienthal. National Bureau of Standards. *U.S. Atomic Energy Commission,* NBS-4555, Feb. 1, 1956, 19 p.

The analyses of 30 platinum-uranium alloys containing from 0.2 to 95% of platinum. Detailed procedures and experimental data included. Platinum is determined by a stannous chloride-spectrophotometric method in the presence of uranium or by a sulphide-gravimetric method. (S11b, S11k; Pt, U)

153-S. Studies on Ball Bearing Steels (II): Effect of Some Metallurgical Factors on the Life of Ball Bearing Steels. T. Mitsuhashi, M. Ueno and Y. Nakano. Translated by University of Alabama (U.S. Bureau of Ships). *U.S. Office of Technical Services,* PB 121427, July 1956, 17 p. $.50.

Improvement in the life of Japanese domestic ball bearings was sought through a study of the relationship between metallurgical factors and life span. Bearing trouble has been occurring mainly at the inner ring, next on the ball, and then on the outer race. Using inner rings whose life-span had been determined, tests were run on chemical composition, nonmetallic inclusions, hardness, compressive loading, cementite content, grain size and degree of forging. (S21; ST, SGA-c)

154-S. Simultaneous Polarographic Determination of Cadmium and Tin. G. W. Latimer, C. D. Houston and K. E. Eubank. (Wright Air Development Center) *U.S. Office of Technical Services,* PB 121685, Sept. 1956, 13 p. $.50.

An improved method of polarographic analysis to determine simultaneously the percentage of concentration of cadmium and tin is described. Results were judged according to synthetic standards. (S11m; Cd, Sn)

155-S. Polarographic Determination of Gallium in Aluminum and Aluminum Alloys. G. W. Latimer and C. D. Houston. (Wright Air Development Center) *U.S. Office of Technical Services,* PB 121720, Sept. 1956, 17 p. $.50.

Determining aluminum with a polarograph is adapted for analyzing and determining large gallium concentrations in aluminum and particularly to prevent interference of the hydrogen wave. (S11m; Al, *Ga*)

156-S. (Book.) **1956 Supplement to Book of ASTM Standards Including Tentatives. Part 1. Ferrous Metals.** 452 pages. 1956. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. (S22; Fe, ST)

Metal Products and Parts

76-T. Cast Iron Glass Moulds. *British Cast Iron Research Association, Bulletin,* v. 13, Jan. 1957, p. 629-633.

Bibliography containing abstracts of 20 papers published since February 1949. (T29, 17-7; CI)

77-T. Russian Survey, Part Five. The Moscow Automatic Ball Bearing Factory. Peter Trippe. *Metalworking Production,* v. 101, Jan. 11, 1957, p. 47-70.

Detailed description of completely automated bearing factory with capacity of 1½ million bearings a year. (T7d, 18-24)

78-T. Fast Start for 200 Series. *Steel,* v. 140, Feb. 11, 1957, p. 104-105.

The 200 series of low-nickel stainless is expected to find increasing use in the fields of transportation, food processing and household appliances. (T general; SS)

79-T. (French and German.) **Aluminum Posts From Thin-Walled Tapered Tubes.** Kurt Diem. *Aluminium Suisse,* v. 7, Jan. 1957, p. 3-13.

Advantages in using aluminum instead of steel in the manufacture of tapered posts and masts; methods of production and problems involved; examples of application such as lamp posts, antenna masts and electric pylons. (T26; Al)

80-T. (French and German.) **Aluminum Winding for the Coiling of the Large Electromagnets of the Geneva Cyclotron.** J. Loetscher. *Aluminium Suisse,* v. 7, Jan. 1957, p. 21-22.

Utilization of aluminum of 99.75% purity in the manufacture of two very large spools, each weighing over three tons; sketches the method of production. (T11; Al)

81-T. Beryllium as an Aircraft Structural Material. George A. Hoffman. *Aeronautical Engineering Review,* v. 16, Feb. 1957, p. 50-55, 82.

Study on beryllium, including structural evaluation, economic considerations and a hypothetical example with suggestions for research. 6 ref. (T24; Be, SGB-s)

82-T. Platinum Metals in the Chemical Industries. J. M. Pirie. *Chemical and Process Engineering,* v. 48, Jan. 1957, p. 11-14.

Platinum in the glass industry; uses in electric resistance furnaces and temperature measurements; catalytic uses. (T29, X9, 17-7; Pt)

83-T. Aluminum and Its Alloys in Chemical Engineering. E. Elliott. *Chemical and Process Engineering,* v. 38, Jan. 1957, p. 19-22.

Various forms of aluminum and its alloys available; developments in the application of these metals in chemical engineering. (T29; Al)

84-T. New High-Strength Aluminum Alloy. R. Zuech and R. G. Cron. *Light Metal Age,* Feb. 1957, p. 23-26.

42B aluminum casting alloy is designed to fulfill the need for a high-strength casting alloy with good ductility for use in critically loaded aircraft and missile structures. The alloying elements are principally silicon and magnesium with small additions of beryllium and sodium. Casting operation described. (T24, E11; Al, *Si, Mn*)

85-T. Could Beryllium Be Used as a Structural Material? George A. Hoffman. *Materials and Methods,* v. 45, Feb. 1957, p. 100-103.

Beryllium's lightness and high stiffness-to-weight ratio provides promising properties if the problems of brittleness, high cost, availability and toxicity are overcome. (T26, Q general; Be)

86-T. Metal-Graphite Brush by Coated Powder Method. II. Tatsuo Matsukata. *Osaka University, Technology Reports,* v. 6, Oct. 1955, p. 425-431.

The characteristics of metal graphite brushes manufactured with the copper-lead alloy coated graphite powder are investigated. The abrasiveness of the metal-graphite brushes manufactured with powders of copper-lead-alloy coated graphite powder is lower than that in any other brushes manufactured by usual process. 4 ref. (T1; Cu, Pb, NM-k36, 6-18)

87-T. Specs for Missile Metals. Edward A. Loria. *Steel,* v. 140, Feb. 25, 1957, p. 86-90.

Specific heat, thermoconductivity, thermo-expansion, melting point, mechanical properties at elevated temperatures, corrosion resistance, stress resistance and low specific gravity are properties to be considered in developing metals with metallurgical requirements needed for missile structure and plain protecting elements. (T2, P general, Q general)

88-T. High-Speed Problems of Large Airplanes. George S. Schaiver. *American Society of Naval Engineers, Journal,* v. 69, Feb. 1957, p. 45-50.

Great emphasis is placed on the development of titanium structures with sandwich arrangement. Temperature problems, stability and control problems for airplanes are discussed. (T24, 2-12; Ti, 7-9)

89-T. Materials Used in Radio and Electronic Engineering. The Electrodeposition of Metals. E. E. Webster and R. W. Stobbs. *British Institution of Radio Engineers, Journal,* v. 17, Jan. 1957, p. 35-47.

Uses of electroplated coating include decoration, corrosion protection, joining, electroforming and parts rebuilding. Brass, cadmium, chromium, copper, nickel, rhodium, silver and tin plates are employed. (T1, X15, 17-7; Cu, Cd, Cr, Ni, Rh, Ag, Sn, 8-12)

90-T. Use of Aluminum in the Chemical Industry. *Canadian Chemical Processing,* v. 41, Feb. 1957, p. 34-44.

Some information on the use and performance of aluminum alloys, and a review of aluminum corrosion tests. 17 ref. (T general, R11; Al)

91-T. Oxide Fuel Elements for High Temperatures. J. H. Handwerk and R. A. Noland. *Chemical Engineering Progress,* v. 53, Feb. 1957, p. 60F-62F.

Nuclear reactors operating in the higher temperature regions are expected to use ceramic fuel elements. Among the problems inherent in such fuels, particularly the ceramics, are high internal temperature due to poor thermal conductivity and escape of volatile fission products due to fissuring. Thoria-urania fuel elements described as corrosion resistant to water at high temperatures. (T11, R4, 2-12; Th, U, 14-18)

92-T. Titanium Carbide. W. E. Montgomery. *Machine and Tool Blue Book,* v. 52, March 1957, p. 160-161. (CMA)

Firthite Cermet Grade WF, a titanium carbide-molybdenum carbide alloy bonded with nickel, is well suited to high-speed cutting and has high wear resistance. Data on physical properties and cutting performances are tabulated. (T6, Q9n; Ti, 6-19)

93-T. The Development of Refractory Nozzle Blades for Use in High-Temperature Gas Turbines. T. H. Blakeley and R. F. Darling. *North-East Coast Institution of Engineers and Shipbuilders,* Preprint, Feb. 8, 1957, p. 231-252.

Numerous materials were tested in the laboratory under conditions designed to simulate the stress and thermal shocks that will be encountered in service. Various methods of manufacturing the required blade shapes were investigated and the shapes were modified to some extent to meet special requirements of the materials. (T7, Q10a; SGA-h)

94-T. New Uses for Tin in Nuclear Power. *Tin,* Feb. 1957, p. 29-30.

Tin and zirconium alloys for atomic power (based on a new booklet of the Malayan Tin Bureau, Washington, D.C.). (T11; Sn, Zr)

95-T. SRE Zirconium Problems. R. L. Carter. *U.S. Atomic Energy Commission,* TID-7525, Jan. 15, 1956, p. 169-186. (CMA)

Stress calculations in the zirconium moderator cans in the Sodium Reactor Experiment show strain relief through grain growth in certain areas of the cans. Tensile strengths and fatigue limits were correlated for oxygen-oxidized zirconium, oxygen-rich, sodium-oxidized zirconium, and zirconium with a hydrogen content. A parabolic rate of oxygen absorption is observed for zirconium exposed to liquid sodium below 1000° F.; the activation energy is 29,400 cal. per mole. Grain growth has been controlled through the use of cold traps for hydrogen and sodium below 950° F. (T11, N3, P12; Zr)

96-T. Preparation of Thin Tritium-Zirconium Targets. B. J. Massey. Oak Ridge National Laboratory, *U.S. Atomic Energy Commission, ORNL-2237,* Feb. 21, 1957, 8 p. (CMA)

The preparative procedure for thin, evaporated titanium-zirconium targets, used as a source of neutrons, is given. The alloying of backing metal with zirconium is considered. The most serious limitation of such targets is the inability of the zirconium to retain the impregnated tritium at high temperatures. For any long period, only 10^9 neutrons per sec. can be generated. (T11; Zr, EG-n43)

Plant Equipment

68-W. Spalling Tests on Blast Furnace Brick. K. A. Baab. *American Ceramic Society, Bulletin,* v. 36, Jan. 1957, p. 14-17.

Standard tests for predicting spalling behavior during initial heating and for determining maximum heating rate for various sizes of blast furnace brick. Results of a modified panel spalling test. (W17; RM-h)

69-W. Russia's Conveyorized Machine-Tool Production. Peter Trippe. *American Machinist,* v. 101, Feb. 11, 1957, p. 146-150.

Processes in Russian factory's producing lathe and radial drilling machines. (W25, 18-24)

70-W. Metallurgical Considerations of Main Steam Piping for High-Temperature, High-Pressure Service. H. S. Blumberg. *Blast Furnace and Steel Plant,* v. 45, Feb. 1957, p. 220-224; disc., p. 250-251.

Requirements for base piping metal and weldments. Service history of various steel used in piping for steam plants. 10 ref. (W10, 17-7; ST)

71-W. Light Gage Steel Connection With High-Strength High-Torqued Bolts. George Winter. *International Association for Bridge and Structural Engineers, Publications,* v. 16, 1956, p. 513-528.

It is shown that fewer high-strength bolts are required, connection slip can be eliminated by using these bolts, and that a lower factor of safety is warranted than when using ordinary bolts .(W1, 17-7; ST)

72-W. How to Avoid Problems With Damp Electrodes. A. C. Ward. *Iron Age,* v. 179, Feb. 7, 1957, p. 108-110.

Lime or titania coatings on stainless electrodes readily absorb moisture causing porosity in weld. Suggestions for detecting and correcting dampness. (W29; SS)

73-W. Resistance-Heat Titanium for Brake-Forming. *Iron Age,* v. 179, Feb. 14, 1957, p. 130. (CMA)

Two innovations have been added to the conventional setup for brake-forming: a controlled resistance heater of 50 kva. capacity, and a holding fixture with quick-acting clamps and power leads only at one end. Both are portable. A ceramic coat electrically insulates the die surfaces and back gages. (W20, G1; Ti)

74-W. Electric Arc Furnaces: Use in Steel Foundries and Bulk Steel Production. F. S. Leigh. *Iron and Coal Trades Review,* v. 174, Jan. 11, 1957, p. 83-90.

Advances in the design and construction of arc furnaces. (W18)

75-W. Russian Survey. Part Six. Conveyorized Production of Machine Tools. Peter Trippe. *Metalworking Production,* v. 101, Jan. 18, 1957, p. 91-112.

Processes in Russian factories producing lathes and radial drilling machines. (W25, W12, 18-24)

76-W. Russian Survey, Part Seven. Peter Trippe. *Metalworking Production,* v. 101, Jan. 25, 1957, p. 135-152.

Automation meets the demand for special machines for new lines by spreading orders around the industry. (W25, 18-24)

77-W. Russian Survey, Part Eight. Peter Trippe. *Metalworking Production,* v. 101, Feb. 1, 1957, p. 179-184.

Every machine tool plant builds specials in parallel with its production of standard types and this is also true in the production of grinding machines. (W25)

78-W. Nitride-Bonded Silicon Carbide. W. L. Wroten. *Product Engineering,* v. 28, Feb. 1957, p. 135-139.

Use of nitride-bonded silicon carbide in centrifugal pump for transferring molten aluminum. (W13, 17-7; Si, 6-19, Al)

79-W. Oxygen Through the Roof. *Steel,* v. 140, Feb. 11, 1957, p. 112-116.

A water-cooled oxygen probe is positioned through the specially constructed roof of openhearth. The apparatus and its advantages. (W18, D2g)

80-W. Horizontal Furnace Heats Extrusions. A. F. Snow. *Steel,* v. 140, Feb. 18, 1957, p. 155-156.

Furnace designed for heat treating aluminum extrusions up to 100 ft. in length has shorter heating time, less material handling and gives improved properties with less distortion than vertical furnaces previously used. (W27; Al, 4-8)

81-W. (French.) **Induction Furnaces for Firing and Smelting Reviewed.** J. Minissieux. *Revue Geneale de l'Electricite,* v. 65, Nov. 1956, p. 623-632.

Survey of the various types of induction furnaces, recent modifications in techniques, various new fields of application and extension of use in the development of new products .(W18, C21d, D6)

82-W. (French.) **Survey of Water in Steelmaking.** Pierre Mosel. *Revue Technique Luxembougeoise.* No. 4, Oct.-Dec. 1956, p. 208-210.

Uses and importance of adequate water supply in steelmaking with special reference to the needs and extent of consumption of iron and steel industries in Luxembourg during 1955. (W10; ST)

83-W. (French and German.) **Aluminum in Atomic Industry.** Jürg Staehelin. *Aluminium Suisse,* v. 7. Jan. 1957, p. 23-28.

Indicated that the low radioactivity of aluminum permits its use in the construction of atomic reactors and remote-controlled devices for manipulating radioactive substances; notes also the utilization of aluminum in the separation of uranium-238 from uranium-235 by diffusion and in protective coatings against radioactive liquids and dust. (W11, 17-7, C6b; Al, U)

84-W. Yesterday, Today, Tomorrow —Pipeline Steels. *American Society of Mechanical Engineers,* Preprint 56-A-97, Nov. 1956, 19 p.

History of line pipe manufacture; welding characteristics; research in progress; transportation of coal in pipeline. (W10, 17-7; ST)

85-W. Bibliography on Pressure Die Casting Equipment. G. L. Cooper. *British Atomic Energy Research Establishment,* A.E.R.E. INF/BIB 108, Oct. 1956, 9 p.

References covering the period 1945-1955, organized as follows: (1) general references, (2) machines, (3) dies. (W19, E13)

86-W. Roof Performance in the Third Campaign of an All-Basic Openhearth Furnace. G. R. Rigby and H. M. Richardson. *British Ceramic Society, Transactions,* v. 56, Jan. 1957, p. 22-36.

Examination in the laboratory of (a) samples of the unused magnesite-chrome bricks, (b) a 4-in. thick peel from the working-face of the roof after 633 heats, and (c) bricks taken at the end of the campaign. Chemical, X-ray and petrological examinations all revealed that iron oxide, lime and silica had been absorbed at the hot face and had migrated into brick. Factors contributing to the long life of this roof are tentatively suggested. (W18; RM-h)

87-W. Convection Stoving Ovens. W. G. J. Appleton. *Electroplating and Metal Finishing,* v. 10, Feb. 1957, p. 36-40.

Radiant and convection systems of stoving each have their own particular merits and limitations. Surveys various types of convection stoving systems with the advantages and disadvantages of each, illustrated with examples from practice. Comparisons with radiant heating processes made. (W3)

88-W. Steel Castings Shrug Off Wear and Impact Abuse. C. G. Mickelson. *Iron Age,* v. 179, Feb. 21, 1957, p. 100-101.

Wearpact, a low-alloy steel, shows unusual tensile and impact strength with high wear resistance. Field tests indicate usefulness as dipper points on mine shovels and crusher linings. (W14, Q9n, Q6n, Q27a; Ay-b, 5)

89-W. Air Conveyors Breeze Through Tough Handling Chores. E. J. Egan, Jr. *Iron Age,* v. 179, Feb. 14, 1957, p. 115-118.

Air conveyors of the bulk type unload and move materials while carrier-type conveyors deliver paper work, small tools and parts. (W12)

90-W. High-Nickel Electrode Welds Most Dissimilar Metals. *Iron Age,* v. 179, Feb. 14, 1957, p. 122-123.

Test data for welds between mild and stainless steel or other dissimilar metals indicate welds made with standard arc welding processes and high nickel electrodes have desirable mechanical property. Electrodes eliminate some cracking and buckling problems. (W29; Ni)

91-W. Protection of Refractories by Moving Air Curtains. J. H. Chesters, C. Holden and A. D. Robertson. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 177-200.

Starting from the conception of a furnace in which the air enters at the opposite end to the fuel to form a sheet separating the flux-laden combustion gases from the refractories, the simpler idea of a moving air curtain directed from the backwall skewbacks over the underside of the roof has been developed. Studies made both in the laboratory and on actual openhearth furnaces show that what at first appeared to be a very simple idea is, in fact, quite complex, a moving air curtain entraining substantial quantities of furnace gases and being penetrated surprisingly easily by both coarse droplets and fine fume. 6 ref. (W18)

92-W. Dip Brazing With Paste Filler. Donald E. Wernz and Mel M. Schwartz. *Materials and Methods,* v. 45, Feb. 1957, p. 118-120.

New aluminum paste filler is replacing conventional sheet and wire brazing preforms in some dip brazed assemblies. Preforming time is eliminated, fillets are smoother and stronger and gaps may be larger. (W29, K8)

93-W. Magnesium Tooling Plate Proves Its Merits as Tooling Material. *Modern Industrial Press,* v. 19, Feb. 1957, p. 36-38.

Combination of light weight, machinability, stability and cost make magnesium tooling plate especially well suited for tooling applications such as stretch form dies and filler snakes. (W24, W25, 17-7; Mg)

94-W. Filler Metals for Joining. Orville T. Barnett. *Welding Engineer,* v. 42, Feb. 1957, p. 38-40.

Composition, tensile strength and ductility of deposited metal from high-tensile, low-alloy steel electrodes and the applications of these electrodes. (W29, Q27a, Q23p; 7-1)

95-W. (English.) **Special Steels for the Manufacture of Boiler Tubes.** *Aciers Fins et Spéciaux Francais,* no. 24, Dec. 1956, p. 55-61.

Mechanical and chemical properties sought in high-grade boiler steels in addition to good ductility at working temperatures; principal grades of steels used in France for boiler construction. Favors austenitic steels derived from the typical 18-8 type. (W11, 17-7, Q general; SS-e)

96-W. (French.) **The Martin Furnace, Terni System.** A. Rossin. *Institut de Recherches de la Siderurgie (IRSID) Publications, Series A.,* no. 127, Dec. 1956, p. 193-203.

Details of the construction and results of the use of an improved type of Martin furnace. (W18)

97-W. (French.) **Light Metal Pipelines for Oil Fields.** André Chevrier. *Revue de l'Aluminium,* no. 239, Jan. 1957, p. 82-83.

Owing to the good behavior of aluminum in the presence of crude oil, even containing sulphur, it has been possible to design pipe systems with no extra thickness to cope with corrosion. Light weight, ease of handling and transportation, and the flexibility of the couplings of such pipes reduce laying and recovery expenses to a considerable measure. (W14, 17-7; Al)

98-W. Materials Problems in Nuclear Reactors. C. O. Smith. *American Society of Naval Engineers, Journal,* v. 69, Feb. 1957, p. 37-44.

General requirements of reactor materials, process of fission, components of a reaction, requirements for submarines. (W11, 17-7)

99-W. Refractories in the Foundry. J. H. Cannon and A. L. Bradley. *Engineer and Foundrymen,* v. 21, Jan. 1957, p. 60-65.

The failure of refractory materials, physical aspects of cupola lining life, and types of linings. (W19; RM-h)

100-W. Refractories in Cupola Practice. J. R. Park. *Foundry Trade Journal,* v. 102, Feb. 7, 1957, p. 165-167.

Desired properties of lining materials, technical and practical aspects of repair and maintenance of linings. (W18, RM-8)

101-W. Steelworks' Lubrication Practice: British Engineers Study German Methods. H. Peter Jost. *Iron and Coal Trades Review,* v. 174, Feb. 1, 1957, p. 275-276, 280.

German lubrication systems: single line system, closed fabric bearings, slipper and palm end lubrication and specifications for lubricants. (W10, 18-23)

102-W. A New Look in Milling Cutters. Joseph R. Varnak. *Machinery,* v. 63, March 1957, p. 151-156.

Increases in cutting speeds have been realized by increased rake angles. Average cutter life between grinds was greater for high-rake tools, also a better finish and smaller burrs resulted, and most satisfactory coolant was found to be soluble oil type for high-rake tools. (W25, 17-7; NM-h)

103-W. Metallurgical Progress and the Steam Engineer. L. Sanderson. *Steam Engineer,* v. 26, Feb. 1957, p. 147-149.

An annual review of developments in metallurgy and materials for steam engineers. (W11, 17-7)

104-W. (French and German.) **The Blow Torch Used for Heating in Industry.** Jacques Delambre. *Zeitschrift für Schweisstechnik,* no. 2, Feb. 1957, p. 37-45.

Construction and mode of operation of several types of welding torches; extension of the use of the blow torch to various aspects of metalworking, such as forging and forming, has necessitated changes in design allowing for multiple nozzles, quick change-over from propane to acetylene and easy regulation of the flame. (To be continued.) (W29)

105-W. (German.) **Construction Principles for Crane Bridges.** Karl Eckinger. *Stahl und Eisen,* v. 77, Jan. 10, 1957, p. 15-23.

Torsional tests on American high-web crane girders to check the validity of Bredt's formula. Stress measurements on crane girders of the classic type. The tubular girder. Model tests on box girders. Different framework designs. (W12, 17-7, Q1, 1-4; ST)

106-W. (German.) **Torsion-Proof Box Girders in the Construction of Mill Cranes.** Heinz Schwarz. *Stahl und Eisen,* v. 77, Jan. 10, 1957, p. 24-32.

Changing over from the framework girder to the box-type girder. Design problems in the construction of heavy cranes. Crane construction and welding technique. The application of the box girder and its simplified maintenance. (W12, 17-7, 17-1; ST)

107-W. (German.) **Contribution to the Standardization of Mill Crane Gears.** Albrecht Wolf. *Stahl und Eisen,* v. 77, Jan. 10, 1957, p. 33-36.

Bordering standard and design standard. Establishment of standard distances between axles as a base for gear standardization. Possibilities and critical evaluation of a standard series for axle distances. Loading of gear steps and dimensions of cases and gear sets. (W12, 17-7, T7; ST)

108-W. (German.) **Present State of Development of Waste Heat Boilers and Cooling Plants for Openhearth Furnaces.** Werner Schemman. *Stahl und Eisen,* v. 77, Jan. 24, 1957, p. 78-84.

Various types of boilers and of furnace door cooling frames. Other furnace cooling elements. References to further development and standardization. 3 ref. (W10, W18)

109-W. (German.) **Practical Experiences and Damages Encountered With Waste Heat Boilers and Cooling Plants for Openhearth Furnaces.** Werner Heil. *Stahl und Eisen,* v. 77, Jan. 24, 1957, p. 84-91.

Influence of cleaning methods on design of La Mont boilers installed at openhearth furnaces. Blowing-off with compressed air or steam, jolting, rinsing with water and cleaning with a shower of balls. Various breakdown causes. 3 ref. (W10, 18-21)

110-W. (German.) **Method of Cleaning the Waste Heat Boiler Installed at an Openhearth Furnace.** Paul Jacobi. *Stahl und Eisen,* v. 77, Jan. 24, 1957, p. 91-95.

Operational experience in cleaning a waste heat boiler. Wet cleaning and cleaning with a shower of balls. Simultaneous use of the two cleaning methods. Wear of boiler parts. (W10, 18-21)

111-W. (German.) **Economic and Technical Results of the Operation of Waste Heat Boilers and Cooling Plants Installed at Openhearth Furnaces.** Max Zur. *Stahl und Eisen,* v. 77, Jan. 24, 1957, p. 95-100.

Design of the openhearth steel plant. Layout of the waste heat boiler and cooling plant. Quantity and heat consumption per ton of steel produced. Economic aspects and initial cost of the waste heat and cooling plants. (W10, 18-17, 17-3)

112-W. (German.) **Statistical Analysis of Breakdowns in Electrical Plant Equipment of Steel Mills.** Volkmar Steinecke. *Stahl und Eisen,* v. 77, Jan. 24, 1957, p. 100-103.

Importance of recording and analyzing breakdowns in the electrical equipment. Mathematical statistical analysis as a means to evaluate the susceptibility to breakdowns. Breakdown statistics and operational experiences. 8 ref. (W11, 18-21)

113-W. (Swedish.) **Planning of Foundry Ventilation.** Karl Nilsson. *Gjuteriet,* v. 12, Dec. 1956, p. 161-163.

Ventilation with regard to the building and the production methods in the foundry. Importance of simultaneous planning. (W10, E general)

114-W. (Report.) **Tentative Specification for Brazing Filler Metal.** *American Society for Testing Materials,* ASTM B 260-56T, AWS A5-8-56T, 1956, 11 p.

The 29 classifications included in this edition cover every type of brazing filler metal in common use today. The new revision provides details on chemical compositions of the filler metals, standard sizes and lengths, packaging and marking. (W27; SGA-f, 15-18)

115-W. (Book—German.) **Rolling Mill Furnaces and Additional Plant Facilities.** Friedrich Karl Reintsch. 91 p. 1956. Fachbuchverlag, Leipzig, Germany.

A survey. Topics covered are heating and reheating furnaces, preheating, firing methods, fuels, materials and construction of rolling mill furnaces, control and measuring devices. Literature and source bibliography. (W20)

Instrumentation X

Laboratory and Control Equipment

26-X. Grinding Temperatures. J. E. Mayer, Jr., and M. C. Shaw. *Lubrication Engineering,* v. 13, Jan. 1957 p. 21-27.

Apparatus for measuring the temerature of a freshly ground surface by means of a photoconducting lead sulphide cell and an oscilloscope. 21 ref. (X9, G18)

27-X. A Pneumatic Level Indicator for the Continuous Casting Process. A. G. Grimshaw and B. O. Smith. *Iron and Steel Institute, Journal,* v. 185, Feb. 1957, p. 235-237.

The pneumatic gaging principle is applied to a level indicator suitable for the continuous casting process for steel. The level indicator provides an electrical output signal which could be used to control either the rate of pouring from the tundish, or the rate of withdrawal of the ingot. (X13, D9q; ST)

28-X. (German.) **Gas Propulsion of Liquids Through Porous Powdered Metals.** W. Siemes and E. Borchers. *Chemie-Ingenieur-Technik,* v. 28, Dec. 1956, p. 783-786.

A description of filters made from powdered metals; the relationship of the size of bubbles to the size of pores and the rate of flow of water, and the loss of pressure from the bubble formation. 10 ref. (X22; 6-21)

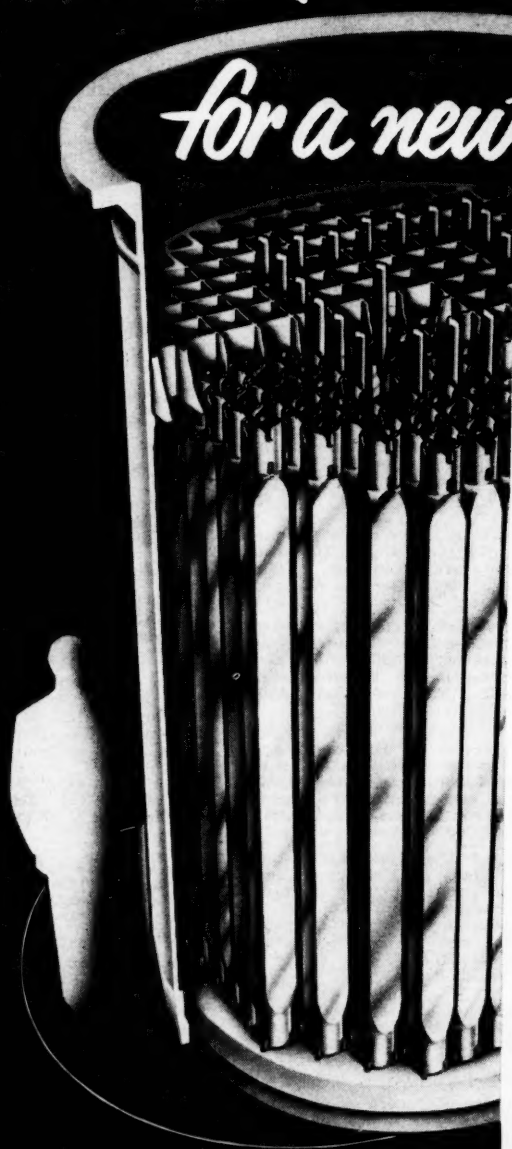
29-X. Can "Ultrasonic Micrometers" Measure Work Being Machined? H. A. F. Rocha. *American Machinist,* v. 101, Feb. 25, 1957, p. 154-155.

Principles of ultrasonic thickness and gap measurements, future possibilities include automatic control of machining operations. (X21, 1-24, G17)

30-X. A New Electrolytic Cell for the Isolation of Carbides and Non-Metallic Inclusions in Steel. Nils Backstrom, Sakari Heinskanen and Urpo Ilme. *Metallurgia,* v. 55, Feb. 1957, p. 101-102.

Previously abstracted from original (*Jernkontorets Annaler,* v. 140, no. 10, 1956, p. 812-816). See item 6-X, 1956.

New alloys for a new era



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One such problem is to find uranium alloys which are corrosion resistant to high temperature water. To provide corrosion protection in the reactors built to date, fuel elements have been clad with new zirconium alloys which were first commercially produced and developed at Bettis Plant. Metallurgists are also working to find uranium alloy fuel elements that have a low neutron capture cross section and will remain stable under irradiation. The development of new alloys for nuclear reactors is but one phase of the metallurgical research and development going on in Bettis Plant laboratories.

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The expansion of research and development programs of the U. S. Bureau of Mines, as proposed in its budget for the coming fiscal year, creates additional opportunities for engineers and scientists interested in Government career positions. The Bureau is now seeking metallurgists, ore dressers, engineers (mining, petroleum, mechanical and electrical), chemists, physicists, nuclear physicists, and qualified specialists in other technologies. Vacancies range from GS-5 ($4480 a year) to GS-12 ($7570 a year) and include some high level administrative and supervisory jobs. Applications may be directed to the Bureau's headquarters (U. S. Dept. of the Interior, Bureau of Mines, Washington 25, D. C.) or to any of the following field installations of the Bureau of Mines: Tuscaloosa, Ala.; Juneau, Alaska; Tucson, Ariz.; Denver, Colo.; College Park, Md.; Minneapolis, Minn.; Rolla, Mo.; Reno or Boulder City, Nev.; Bartlesville, Okla.; Albany, Ore.; Bruceton, Pittsburgh or Schuylkill Haven, Pa.; Rapid City, S. Dak.; Knoxville or Norris, Tenn.; Amarillo, Tex.; Salt Lake City, Utah; Seattle, Wash.; and Morgantown, W. Va.

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TITANIUM METALLURGIST: Age 33, married, B.S. degree in metallurgy. Four years experience in ferro alloys production and research, four years in titanium metal processing and marketing, three years in management of vacuum melted alloy sales. Desires responsible position in sales or engineering management. Minimum salary $12,000. Prefers east of Indiana. Box 4-35.

RESEARCH METALLURGIST: B.S. degree, age 28. Seven years experience in all aspects of refractory metal alloy development, molybdenum and niobium, including sintering, fabrication, cladding, vacuum techniques and vacuum creep testing. Desires basic or applied research position with metal producer interested in chromium, niobium and molybdenum-base alloys. Box 4-40.

METALLURGICAL ENGINEER — FORGE PLANT MANAGER: Diversified experience in estimating tooling, production rates, and equipment capacity; tool design, inspection and heat treating; activating, operating and maintaining forging equipment; production of open-die, conventional drop, no-draft and close tolerance forgings of ferrous, nonferrous and high-temperature alloys. West preferred. Box 4-45.

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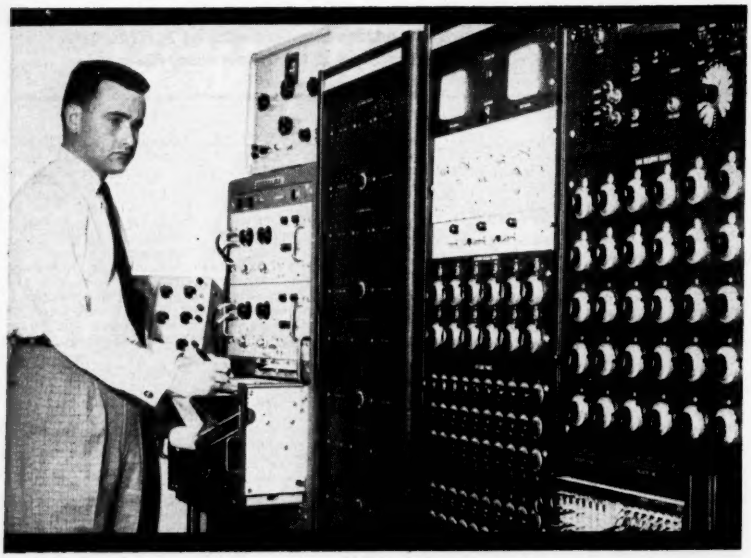

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METALLURGIST: B.S. degree, M.I.T., single, age 26. Desires position of responsibility and growth in metallurgical development or production. Prefers Metropolitan New York-New Jersey area. Box 4-55.

METALLURGIST: Indian national, M.S. in metallurgy from Colorado School of Mines, about ten years experience in lead smelting and refining. Can work as metallurgist, chemist or spectrographer. Available January 1958. Box 4-60.

METALLURGICAL ENGINEER: Prefers Europe. Ph.D., age 30. Background includes development work in metallurgy and chemical engineering. To represent interests of U.S. manufacturing company in the newly created European Commun Market area. Born in Europe, American education. Speaks and writes fluently English, French and German. Business experience, willing to travel. Consider several months training program before leaving U.S. for Europe. Box 4-65.

METALLURGICAL ENGINEER: B.S. degree, age 27, married, veteran. Five years experience in field of powder metallurgy of refractory metals. Work included process control, process development, product development and specialized equipment design. Desires position with progressive company, preferably in South America or on West Coast. Box 4-70.

METALLURGICAL ENGINEER: Graduate, age 33, married. Eight years diversified experience in steel research and development, and production. Prefers position with technical-production or technical-management responsibilities with progressive company in south or Southwest. Box 4-75.

METALLURGICAL ENGINEER: Interested in position in applied research and development, product development and manufacturing supervision. Background in carbon, alloy steel and high speed steel heat treatment and applications; melting and fabrication of uranium, thorium and beryllium; processing, fabrication, development and use of tantalum, columbium, tungsten and molybdenum. Graduate in metallurgical engineering and industrial management. Box 4-80.

PROFESSORSHIP: University professorship in metallurgy desired by man with extensive experience in both educational and industrial work, A.B., M.S. and Ph.D. degrees. Experience includes teaching metallurgical subjects on both graduate and undergraduate levels. Fundamental and applied research and general plant control work. Prefers Midwest, Southwest or Rocky Mountain location. Box 4-85.

WELDING ENGINEER: B.S. in metallurgy, M.S. degree soon, age 26, married. Plant metallurgist for small progressive foundry and at present project welding engineer for atomic power laboratory. Experienced in foundry practice, heat treating, toolsteels, etc., and all phases of welding applications. Interested only in welding development from a production viewpoint. Box 4-90.

Midwest—Medium-size manufacturer of nationally distributed steel products seeks **man with training and experience necessary** to assume supervision of Heat Treating Department, and related quality control functions. **Must be familiar with controlled atmosphere furnaces and carburizing methods for production parts. Exceptional opportunity for young man 30 to 38 with growing organization. Degree in metallurgical engineering not required. In reply please give personal data, education, employment history.**

Box 4-155, Metals Review

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METALLURGICAL ENGINEER: Age 29, B.S. degree, candidate for M.S. degree in June. Five years varied industrial experience which includes development and application of soft magnetic materials, high-temperature alloy development, steel foundry and high-temperature testing. Interested in applied research or development activity. Midwest preferred. Box 4-95.

PHYSICAL METALLURGIST: Age 25, expects Ph.D. in October. Experienced in research in high-temperature metallurgy and corrosion. Desires position in research and/or development for progressive firm where opportunities for advancement are excellent. Box 4-100.

METALLURGICAL ENGINEER: Degree, age 27, married. Four years experience in conducting, directing and reporting research and development on welding, one year on heat treatment and failure investigation. To be discharged from Army in September. Desires position in research and development on West Coast. Box 4-105.

METALLURGIST: B.S. degree, age 35, family. Thirteen years diversified experience including nonferrous foundry, forging, extrusion production control, three years laboratory experience controlling ferrous and nonferrous fabrications practices. Supervisory experience. Customer contact and liaison work. Desires position as liaison or sales engineer, or in development. Location unimportant. $850/month minimum. Box 4-110.

METALLURGIST: M.S. degree, age 34, family. Education, experience and interests lie with material and process application. Employed eight years with manufacturers of electrical apparatus and jet engines. Some knowledge of materials for nuclear energy applications. Desires responsible position as supervisory materials engineer. Will consider foreign location. Box 4-115.

METALLURGIST: B.S. degree, age 39. Fifteen years diversified ferrous and nonferrous industrial experience including manufacturing trouble shooting and laboratory supervisory experience. Can get along with people. Wants position in plant metallurgy or sales or service work. Greater Detroit area preferred. Box 4-120.

METALLURGIST: Being released from Army, seeks employment in Los Angeles area. Military obligation fulfilled. Holds 5-year B.S. degree in metallurgy and has had some experience in industry and research before entering service. Available June 15. Box 4-125.

PHYSICAL METALLURGIST: In research and development on steels. Background includes industrial, teaching and research experience. Age 45. No preference as to location. Box 4-130.

PROFESSOR OF PHYSICAL METALLURGY: Desires change. Thirteen years of teaching undergraduate and graduate physical metallurgy courses. Available for fall semester 1957. No location preference. Willing to discuss rank and salary. References upon request. Box 4-135.

PHYSICAL AND MECHANICAL METALLURGIST: Ph.D. degree, age 34, married, veteran. Six years university physical metallurgy teaching experience, three years fundamental mechanical metallurgy research, three additional years diversified industrial metallurgical research in corrosion and elevated temperature fields. Publications. Desires challenging administrative position in metallurgical research or development. Salary from $14,000. Box 4-140.

METALLURGIST: B.S. degree, age 30, married, family. Seven years diversified experience with electrical manufacturer, covering alloy and process development. Supervisory experience. Accustomed to dealing with all levels, from executive to shop personnel. Desires responsible technical position in engineering or sales. Prefers New Jersey, New York area. Will relocate if necessary. Box 4-145.

PHYSICAL METALLURGIST: Age 34, Ph.D. degree, married, family. Five years experience in stainless and high-temperature alloy research and development, four years university teaching and research, industrial consulting, U.S. Army. Primarily interested in industrial research and/or development, but will seriously consider challenging academic position. Very good reputation in being able to get along with people. Box 4-150.

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Exhibitors do not need to be members of the American Society for Metals.

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable.

Photographic prints should be mounted on stiff cardboard; maximum dimensions 14 by 18 in. (35 by 45 cm.). Heavy, solid frames are unacceptable.

Entries should carry a label on the *face* of the mount giving:

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Any special information as desired.

The name, company affiliation and postal address of the exhibitor should be placed on the back of the mount.

Entrants living outside the U. S. A. should send their micros by first-class letter mail endorsed "Photo for Exhibition—May be Opened for Customs Inspection".

Exhibits must be delivered before Oct. 15, 1957, either by prepaid express, registered parcel post or first-class letter mail, addressed:

Metallographic Exhibit
American Society for Metals
7301 Euclid Ave.
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CLASSIFICATION OF MICROS

(*Optical and Electron*)

Class 1. Irons and steels.
Class 2. Stainless steels and heat resisting alloys.
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Class 4. Copper, nickel, zinc, lead and their alloys.
Class 5. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements.
Class 6. Metals and alloys not otherwise classified.
Class 7. Series showing transitions or changes during processing.
Class 8. Welds and other joining methods.
Class 9. Surface coatings and surface phenomena.
Class 10. Results by unconventional techniques (other than electron micrographs).
Class 11. Slags, inclusions, refractories, cermets and aggregates.
Class 12. Color prints in any of the above classes. (No transparencies accepted.)

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $100, will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters in Cleveland.

All photographs may be retained by the Society for one year and placed in a traveling exhibit to the various Chapters. They will be returned to the owners in May 1958 if so desired.

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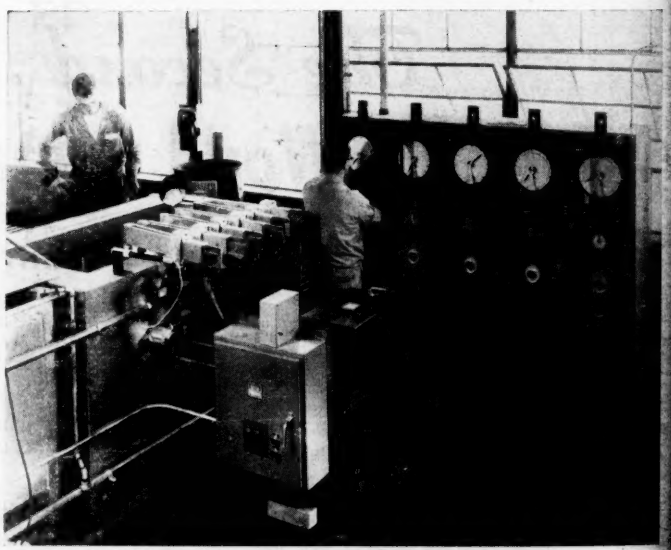

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